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A Study on Consumer Behaviour towards Online Shopping

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1. INTRODUCTION

Consumer behavior is the study of how individual customers, groups or organizations select, buy, use, and dispose ideas, goods, and services to satisfy their needs and wants. It refers to the actions of the consumers in the marketplace and the underlying motives for those actions. Marketers expect that by understanding what causes the consumers to buy particular goods and services, they will be able to determine, which products are needed in the marketplace, which are obsolete, and how best to present the goods to the consumers.

The study of consumer behavior assumes that the consumers are actors in the marketplace. The perspective of role theory assumes that consumers play various roles in the marketplace. Starting from the information provider, from the user to the payer and to the disposer, consumers play these roles in the decision process.

The roles also vary in different consumption situations; for example, a mother plays the role of an influence in a child's purchase process, whereas she plays the role of a disposer for the products consumed by the family.

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2. DEFINITION

According to Engel, Blackwell, and Mansard, 'consumer behavior is the actions and decision processes of people who purchase goods and services for personal consumption.

3. ONLINE SHOPPING

Online Shopping System helps in buying of goods, products and services online by choosing the listed products from website (E-commerce site). The proposed system helps in building a website to buy, sell products or goods online using internet connection. Purchasing of goods online, user can choose different products based categories, online payments, delivery, service and hence covering the disadvantages of the existing system and making the buying easier and helping the vendors to reach wider market.

Online shopping involves purchasing products or services over the Internet. Online shopping is done through an online shop, e-shop, e-store, virtual store, web shop, Internet shop or online store. All the products in online stores are described through text, with photos and with multimedia files. Many online stores will provide links for extra information about their products. They often make available, safety procedures, instructions, manufacture specification and demonstrations. Some will provide advice or how-to guides. As you are already on the Internet, you can search for product reviews that other consumers may

have posted. Some online stores have place for these reviews on their own sites. Many allow users to rate their products. Advice such as this from other consumers, about a product, would be unavailable in a conventional store.

There are many advantages involved with online shopping, the most obvious of which is convenience. As long as you have a computer, online shopping can be done from home or from work. There is no need to take the time to travel to a conventional store. Also, online shops typically operate 24 hours a day so you don't need to rush to get there during business hours. Particularly if you have a broadband Internet connection, browsing online can be done very quickly - in fact, it can be quicker than browsing up

With online shopping, there is no need to wait in queues at the check-out once you have your items. You are not required to lift any heavy or awkward-sized and shaped packages. Your shopping is collected with the click of a button and "deposited" into your shopping trolley by no physical effort on your part.

4. BENEFITS OF ONLINE SHOPPING

- **Convenience:** Where else can you do shopping, even at midnight, you don't have to wait in a line or wait till the shop assistant helps you with your purchases. You can do your shopping in minutes even if you are busy, apart from saving time and avoiding crowds. Online shops give us the opportunity to shop 24 x 7 and also reward us with 'no pollution' shopping.
- **Better Prices:** I get cheap deals and better prices from online stores because products come to you directly from the manufacturer or seller without middlemen involved, many online shops offer discount coupons and rebates.
- **Variety:** One can get several brands and products from different sellers at one Place. You can get in on the latest international trends without spending money on travel; you can shop from retailers in other parts of the country or even the world without being limited by geographic area... These stores offer a far greater selection of colours and sizes than you will find locally. If you find that the product you need is out of stock online, you can take your business to another online store where the product is available.
- **Fewer Expenses:** Many times when we opt for conventional shopping we tend to spend a lot more than the required shopping expenses, on things like eating out, travelling, impulsive shopping etc
- **Comparison of Prices:** Online shops make comparison and **research** of products and prices Possible. Online stores also give you the ability to share information and review with other shoppers who have firsthand experience with a product or retailer.
- **Crowds:** If you are like me, you would like to avoid the crowds when you do the shopping. Crowds force us to do a hurried shopping most of the time. Crowds also create a problem when it comes to finding a parking place nearby where you want to shop and

going back to your vehicle later loaded with shopping bags.

- **Compulsive Shopping:** Many times when we go out shopping we end up buying things which we do not require because of the shopkeepers' up selling skills -- or we'll compromise on our choices because of the lack of choices in those shops.
- **Discreet Purchases:** Some things are better done in privacy. Online Shops enable me to purchase undergarments and lingerie or adult toys without the embarrassment that there are several people watching me and my choices.

5. ONLINE SHOPPING VS. TRADITIONAL SHOPPING

- Shopping is part of every day's life. Some get the necessities from shopping, others get something more. It is viewed as a way to release the stress, a way to complete some desire in the mind, or a way to add some flavour to the mechanical way of life. In general, there are two types of shopping: traditional shopping and on-line shopping. Both of them have some merits and shortages respectively.
- Nowadays, more and more people would 'go shopping 'via Internet, thanks to the prevalence of the computer. Clicking in one word, thousands of items will put out on the screen as your choice. You don't have to wade across a long road and nudge through hustling crowds to get a pair of fancy shoes, for example. All you have to do is to click on the key board, keep your elegant stance (maybe with a glass of wine) and the goods will be delivered to you.

Advertisement and commercial packages may do wonders for the producers; they may do illusions and convey false information for the customers. Another trap that the online-buyers may come across is that, they're easily to expose too much personal data on the Internet.

On the other hand, traditional shopping may exclude the apprehensions that mentioned above. Normally, you rarely have a chance to find a 'weird spectrum' of a suit until you tear up the shopping bag, for you have scrutinized it everywhere from top to toe before you buy it. Everything in traditional shopping is tangible and authentic. It allows you to criticize it before you take it, not the other way around. It may sound more rational to keep commercial dealings!

To be short, each kind of shopping has its advantages and disadvantages. And, it's true that sometimes, merits could be shortages, and vice versa, depending upon the perspective you hold. Perhaps, it's also kind of philosophy that can be testified on something else. If you are the one who enjoy traditional shopping -- - to immerse yourself in the live, colourful stuffs; to converse heartily with the dealers and the co-consumers --

- maybe the 'tiresome harvest' (carry back all the 'trophies') is the climax of the trip!!

6. OBJECTIVES OF THE STUDY

i. To study the consumer behavior towards online shopping

ii. To find the features customer expect in online shopping

7. METHODOLOGY

The research study is descriptive in nature. Convenience sampling method was adopted for this research study. The data were collected by using questionnaire method from 50 consumers. Data were collected through primary and secondary source. Information are collected from the individuals are analyzed with the help of percentage analysis

8. REVIEW OF LITERATURE

Fabian Bourrrat , Mai Nilausen(2012) This is to set out to identify which factors incentivizes luxury customers to purchase online rather than in the physical store. Several insights have been reached, but except for the clear influence of price sensitivity, no completely clear rank of motives can be made .However, the circumstances under which customers are not willing to buy online were also investigated and this reverse approach has also proven insightful. This study has been investigated the reason why luxury customers choose on sales channel over another when making their purchases.

Citrin et al.(2003) pointed out that a high level of prior Internet usage would increase the level of usage for product purchases. Age is an important factor that influences the use of the Internet (Rosen, Weil 1995). Hence, there is a negative correlation between age and the use of new technology, implying that generation Y is more willing to purchase online than generation X (Bergadaa, M., Coraux, G. 2004). Moreover, gender has an impact on the willingness to buy sensory products online: women have a higher tactile need than men. Since the relationship between the need for tactile input and the use of Internet as a purchase channel is negative, men are more willing to buy sensory products online than women (Citrin et al. 2003).

Jarvenpaa, Tractinsky, and Vitale (2000) investigate how consumers. Perceived store size and reputation influence their trust in the store, risk perception, attitudes, and willingness to buy at the specific store. Higher consumer trust also reduces perceived risks associated with Internet shopping and generates more favourable attitudes towards shopping at a particular store, which in turn increases willingness to purchase from that store. Jahng, Jain, and Ramamurthy (2001) propose and validate Technology /Product Fit Model to describe and predict the relationship between product characteristics, e-commerce environment characteristics, and user outcomes. They classify products sold on the Internet as belonging to four categories based on social and product presence requirements: simple, experiential, complex, or social. When a positive fit is established between the ecommerce

ANALYSIS

Table 1 – Personal Profiles of the Respondents

Profile	Groups with frequencies					Total
Gender	Male = 20 (40%)		Female = 30 (60%)			50 (100%)
Age	20-25 = 20 (40%)	25-30 = 10 (20%)	30-35 = 10 (20%)	35-40 = 5 (10%)	Above 40 = 5 (10%)	50 (100%)
Educational Qualification	Graduate = 30 (60%)	Post Graduate = 15 (30%)	Professional = 5 (10%)			50 (100%)
Marital Status	Married = 35 (70%)		Un married = 15 (30%)			50 (100%)
Occupation	Business = 18 (36%)	Government = 6 (12%)	Private =22 (44%)	Other = 4 (8%)		50 (100%)
Annual Income	>Rs.1,00,000 = 25 (50%)	Rs.1,00,001 – Rs.2,00,000 = 10 (20%)	Rs.2,00,001 – Rs.3,00,000 = 10 (20%)	< Rs.3,00,000 = 5 (10%)		50 (100%)

Table 1 reveals that among the 50 respondents demographic profile, Majority of the respondents are female 60%. 40% of the respondents belong to the age group of 20-25, 60% of the respondents are Graduates, 70% of the respondents are married, 44% of the respondents work in private sector jobs, 50% of the respondents annual Income is between >Rs.1,00,000.

When a positive fit is established between the ecommerce environment and the product requirements, favourable user outcomes are generated that include user satisfaction, decision confidence, e-commerce acceptance, and purchase intent.

Dubois, Laurent, and czellar (2001) have tried to investigate consumers "definition of luxury rather than impose one on the research participants. They conducted interviews with respondents who had made at least one purchase or received an item as gift which they considered luxurious .This approach is consistent with Saviolo and corbellini's consideration of luxuriousness being based on the individual judgment.

Table 2 results indicates that 28 % of the respondents have ranked the Favorite online sites Flipkart.com as rank I, 22.4 % of the respondents have ranked Amazon.com as rank II, 20.87 % of the respondents ranked Snapdeal.com as rank III, 16.4 % of the respondents ranked EBay. In as rank IV, 12.4% of the respondents ranked yepme.com as rank V.

Table 2 Weighted Average Ranking

Attributes	Weighted Score	Weighted Average	Rank
Flipkart.com	70	28	I
Amazon.com	56	22.4	II
EBay. In	41	16.4	IV
Snapdeal.com	52	20.8	III
yepme.com	31	12.4	V

9. SUGGESTIONS

Online shopping has traditional not been consider consistent with the concept of luxury and ecommerce still poses some structural difficulties for companies due to issues such as safety of transactions and trust in websites, but legitimacy has yet to be completely established for luxury e-commerce.

The customers believe the online sites provide the exact information and description about the products. Some of the customers felt problem in online shopping like delay in delivery, damaged products, product not according to their descriptions etc., online selling companies must concentrate on these problems faced by the customers.

The main features which a customer expect while shopping online are firstly privacy and security for their personal details next is that it has to be customer friendly and design. More customers are expecting the product to be up to their expectation and preferable are quality and more importance should be given to them.

CONCLUSION

Online shopping is a new experience and has greatly impacted the lives of consumers in its short time of existence. It is expected to grow constantly in years to come with advancements in technology. Online shopping has made consumers more effective and efficient in their shopping behaviour and has driven businesses to a new level, forcing many to make the necessary adjustments and changes to reach the new market of knowledgeable consumers.

The results of this survey underscore the need for businesses to take the online market seriously. The survey conducted revealed a positive attitude and behaviour toward online shopping even by those consumers who still like traditional stores. These consumers are mostly in low and high age groups. Those consumer groups have time to spend in traditional stores and malls and value the offline shopping experience for social reasons, such as meeting with friends.

These consumers appear to be more knowledgeable by gathering information online and then purchase it from traditional stores. Rapid growth of e-commerce has resulted in a E-transformation in the global retail infrastructure. Internet has emerged as a cost effective means of doing business. Despite being faced with numerous bottlenecks, Thanks to rising internet and higher incomes and more savvy population. Secured online payments, better to Electronic Stores, return policies and

exciting discounts could help the Perceptions of Shopping Benefits. Considering the demographic profiles of online users; gender, age and education have significant association to web shopping in the current Indian scenario. The overall results prove that the respondents have perceived online shopping in a positive manner.

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A Comparative Study on Customer Satisfaction towards Online Shopping and Offline Shopping with special reference to Coimbatore District

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Abstract

The rapid development of the internet has strongly impact upon the worldwide marketing environment. Currently it has become one of the popular approaches for business and customer to perform trade over the internet. Businesses have been coming up with creative ways to promote their product via online. Thus it describes how modern market is replacing the traditional markets. This study is taking place to identify the factors that may influence customer's online shopping satisfaction comparatively with the offline shopping. Generally, the success of online shopping essentially depends on the customer satisfaction during their purchase. Customer's satisfaction has become a crucial point of differentiation in online and offline shopping where consumers make weekly, fortnightly or monthly trips and then spend more on these trips than other times especially in countries like India where competition in online is very fierce. Unfortunately in offline shopping, i.e., especially in departmental stores most of the unsatisfied customers do not complaint, they just skip and go shopping for somewhere else. The most popular form of shopping includes those that are click- and- mortar which means stores that have both physical entity and an on-line presence. In this study, the researcher attempts to use different socio – economic variables. This study attempts to analyze the customer's satisfaction of online and offline shopping.

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Keywords: Consumer Satisfaction; Marketing Environment; Online; Offline shopping

1. INTRODUCTION

Offline shopping is called real – time shopping. It is the process of purchasing and selling products or services physically customer's personal interaction with a sales person is required for the product under consideration of intention to shop. It is possible to feel, touch, smell or try the product. If we want a product just now we can buy it from retail store immediately. A traditional retailer bestows the personalized human contact. Shopping with many people is a source of entertainment, almost a social rite. People like to handle things, especially clothes.

Texture and more over they want to try it. Online shopping is the process of purchasing and selling products or services over internet. Online shopping uses computer technology to purchase products from retailers and stores. Online shopping is the large part of electronic commerce. This form of shopping has revolutionized the traditional process of consumers buying goods from a retailer of mall that they must actually to into. Online shopping popularized of its speed and the efficiency with which it can be done.

2. STATEMENT OF THE PROBLEM

Customer satisfaction has become a crucial point of differentiation in online and traditional shopping where consumers make weekly, fortnightly or monthly trips and then spend more on these trips than other times especially in countries like India where competition in online is very fierce. Unfortunately in traditional shopping, i.e., especially in departmental stores most of the unsatisfied customers do not complaint, they just go shopping somewhere else. So the lesson for the retailers is that customer's expectations are always more upward and it is only the satisfied customers that are more likely to remain loyal in the long run. Research has been done over the years in different services sector to find out the drives of customers satisfaction and loyalty with respect to different factors of service quality. But online shopping in India is gradually inching its way towards top and becoming the next zoom industry

Now a day's online shopping are in trouble. They are facing stiff competition from other formats and have to bring in more innovations to satisfy the customers and retain them. So in this juncture the researcher has made comparative study on customer satisfaction about online and offline shopping. A survey has been conducted to find out how for the product and other service components offered by different stores influence and satisfy the customer.

3. OBJECTIVES OF THE STUDY

1) To find out the factors that influences the customers to prefer online shopping and traditional shopping

2) To examine the customer's level of satisfaction towards the products and various services offered by online and traditional shopping.

3) To study the customer satisfaction towards traditional shopping and online shopping in Tirunelveli District.

4. SCOPE OF THE STUDY

The study has been made to find out the customer satisfaction towards offline and online shopping with special reference to Coimbatore district. The researcher also attempted to find out the factors that influences the customers to prefer online shopping and traditional shopping.

5. RESEARCH METHODOLOGY

The study is an empirical research based on the survey method. Both primary and secondary data are collected for the purpose of this study. Primary data had been collected through questionnaire. Secondary data was collected from books, journal, magazines and websites. By using convenient sampling method 300 respondents are selected from Coimbatore district. For analyzing the data, a necessary tool such as Percentage analysis and Chi – square test has been applied Table.

Table 1: Gender Wise Distribution of the Respondents

Gender	No. of Respondents	Percentage
Male	222	74
Female	78	26
Total	**300**	**100**

Most of the respondents covered under the study are male respondents.

Table 2: Age Wise Distribution of the Respondents

Age	No. of Respondents	Percentage
Below 25	168	56
25 - 35	96	32
35 -45	24	8
Above 45	12	4
Total	**300**	**100**

Majority of the respondents are in the age group of below 25 years.

Table 3: Educational Status of the Respondents

Education	No. of Respondents	Percentage
HSC	12	4
UG Degree	135	45
PG Degree	51	17
Professional	102	34
Total	**300**	**100**

Most of the respondents are under graduate.

Table 4: Marital Status of the Respondents

Marital Status	No. of Respondents	Percentage
Married	81	27
Unmarried	219	73
Total	**300**	**100**

Most of the respondents are unmarried

Table 5: Occupation of the Respondents

Occupation	No. of Respondents	Percentage
Employee	171	59
Business	36	12
Agriculturist	9	3
Professional	84	26
Total	**300**	**100**

Most of the respondents are employees

To find out the relationship between age and satisfaction of customer service mentioned in the above the following chi – square test is applied. Since the observed value (9.075) is less than the table value (16.919). Therefore age and satisfaction of customer service are independent variable.

6. FINDINGS

1. It is revealed from the study, majority of the male respondents are maximum (74%) in traditional shopping.
2. On the basis of testing age and level of satisfaction of customer service in traditional shopping, there is no relationship between age and level of satisfaction.
3. When educational qualification compared with level of satisfaction of customer service in traditional shopping, there is no relationship between educational qualification and level of satisfaction.
4. Majority of the (73%) respondents are unmarried.
5. Most of the respondents are employees
6. When monthly income compared with level of satisfaction of customer service in online shopping, there is a significant relationship between monthly income and level of satisfaction.

CONCLUSION

The most popular form of shopping include those that are click- and- mortar which means stores that has both physical entity and an on-line presence.. It is revealed from the study most of the respondents are satisfied with the online shopping comparatively with the offline shopping. The numbers of online stores continues to grow because of the growing popularity in online shopping.

The reason behind this is an increasing number of technological developments. It would be hasty to predict that online shopping will take over for buildings of stores and shopping centers night away. Shopping malls now provide various forms of entertainment, including movie theatres, restaurants, art displays, video amusement complexes, and even amusement parks.

It was found that browsing, or window shopping, is still a popular leisure activity. The use of technology has opened new doors and opportunities that enable for a more

convenient lifestyle today. Variety, quick service and reduced prices were three significant ways in which online shopping influenced people from all over the world. However, this concept of online shopping led to the possibilities of fraud and privacy conflicts. Unfortunately, it has shown that it is possible for criminals to manipulate the system and access personal information. Luckily, today with the latest features of technology, measures are being taken in order to stop hackers and criminals from in appropriately accessing private databases. Through privacy and security policies, website designers are doing their best to put an end to this unethical practice. By doing so, society will continue to depend upon online shopping, which will allow it to remain a tremendous success in the future.

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A Survey on Different Sentiment Analysis Methodologies

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Abstract

Sentiment Analysis (SA) is a branch of NLP. It is also known as opinion mining. Now a days it is a very popular research field. The basic idea behind the sentiment analysis (SA) is to identify the polarity of the text and classify them as positive, negative and neutral. People using online products and services expresses their experience, opinion and sentiment about that product or service in online sales websites (Amazon, Flipkart) or social media sites (Twitter, facebook) or review sites (Epinion). The opinion expressed by them becomes the primary factor for the sales of the product. New users select a product or service based on the reviews. So opinion mining becomes important for business man to understand their product's overall feedback from the customers and for consumers it helps in selecting quality product or good service.

Keywords: NLP, Opinion mining, Sentiment Analysis

1. INTRODUCTION

Sentiment Analysis is a process of extracting emotions or opinions from a piece of text for a given topic [1]. The data for performing SA can be collected from many sources but the social media sites especially twitter plays important role in collecting data for SA. It contains tweets for wide variety of products and services. It is impossible to read all feedbacks to understand a product's performance or service's feature for consumers and for Business people it is not possible to read all reviews or expressions of users to understand their product's popularity among people. So SA becomes a important task to do the above mentioned.

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Terms used in SA

Subjective/ Objective: It is necessary to identify the text is subjective or objective to perform SA. Text with sentiment is subjective (Ex. He is a good boy.) Text without sentiment is known as objective (Ex. He is a student).

Polarity Positive – I love Redmi mobile phone.

Negative – Samsung mobiles are not good in performance in recent years.

Neutral – I usually get hungry at noon.

2. LEVELS OF SENTIMENT ANALYSIS

SA can be done in the following levels.

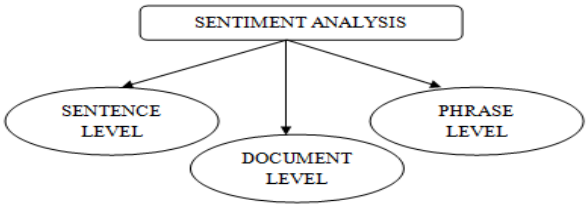

Figure 1. Sentiment Analysis Levels

(a) Sentence level
(b) Document level
(c) Phrase level

The sentence level analysis analyzes each sentence in a document and classify them into positive or negative or neutral. Each sentence in a document may have different polarity.In document level the whole document will be analyzed and the document will be classified into positive or negative or neutral.

The phrase level is deeper than other methods. It identifies the phrases or aspects in a sentence and classify them into positive or negative or neutral. It is also called as aspect based analysis [2].

3. STEPS IN SENTIMENT ANALYSIS PROCESS

The following diagram represents the various steps involved in sentiment analysis process.

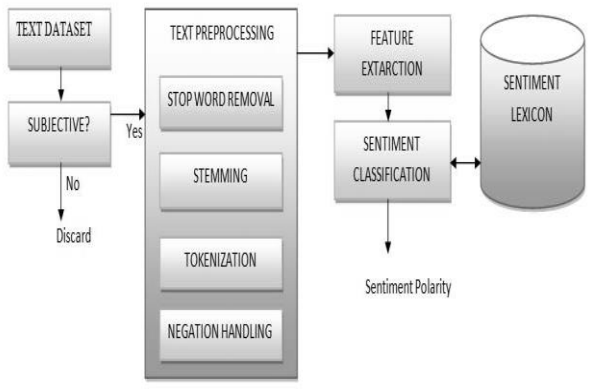

Figure 2. Sentiment Analysis process

(A) Text Pre processing

It involves the following steps.

(i) Stop word removal

Articles (a, an, the) and prepositions ( ) does not affect the sentiment level in a sentence. A dictionary can be used to remove stop words [3].

(ii)Stemming

A word can be written as nouns, verbs etc. The removal of suffixes from the word and replace is it with it's base word is called stemming.

(iii)Tokenization

A single word is also known as token. Text with white spaces is separated as tokens and it forms bag-of-words. It can be used to train the classifier.

(iv)Negation Handling

Negative words inverts the meaning of whole word. The sentence "The food was not so taste" has the word so taste which is positive but the negative word "not" changes the sentence into negative.

4. METHODOLOGY

The following diagram shows the different methods of doing Sentiment Analysis.

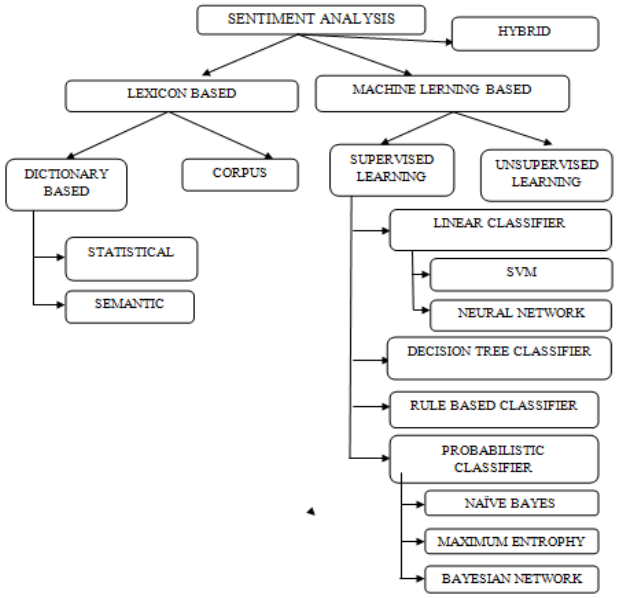

Figure 3. Methods for Sentiment Analysis

There are three techniques for opinion mining.

(A)Lexicon based approach

(B)Machine learning based approach

(C)Hybrid approach

(A)Lexicon based approach

Subjective lexicons are words with score idicates positive, negative or neutral. Positive, negative, neutral and objective socres are added seperately which has the highest score is assigned as a polarity of that sentence. [4]In turn it is divided into two categories. (i)Dictionary based (ii)Corpus base

(i) Dictionary based

It is the easiest way of doing SA. Here opinion word are collected manually and seed list is prepared. It adds synonyms and antonyms whenever new word appears. This continuous till no new words found.

1. Statistical

It finds the occurances of the word. If a word occurs mostly in positive text, is assigned positive polarity and vice-versa.

2. Semantic

It calculates sentiment value by using similarity between words. Wordnet is used for this purpose. Synonyms and antonyms are found in dictionary and sentiment values is calculated [5].

(ii)Corpus based

Corpus is a colleciton of comments or reviews on a particular topic. Here seed list is prepared and expanded with the help of corpus text [6]

(B) Machine learing based approach

It is a automatic technique for classification. Classification is based on features. Features are selected using supervised or unsupervised learing techniques.

(a)Superviesed learing

Here the system trained with labelled data. Every new word is labelled with a class which is the closest one.

(i)Linear Classification algorithms

It does classification on the basis of linear combination value of the characteristics. Let W is word frequency, C is linear coefficient vector and S is scalar then Linear predictor is calculated by

LP=W.C+S

SVM

It finds linear seperator for classification. It is a non-Probabilistic classifier [7].

Neural Network

It is like neural structure of brian. Here there are three layer they are (i) Input layer (ii) Hidden layer (iii) Output layer. A neuron has set of inputs and set of weights and function to add weights and maps these result to final output.

(ii)Decision Tree Classifier

It is based on the divide and conquer methods. If data satisfies one class then it will be palced in that class other placed in other class. It is used in binary classification.

(iii)Rule based classifier

It is based on rules. Rules are generated during training phase on the basis of user's requirement. The rules can be represented as

IF codition THEN decision

(iv)Probabilistic classifier

It can forsee probability function over input data. Ordinary functions assigns input x to class y as

y=f(x)

But in probabilistic classifier the function is replaced by conditional distributors pr(Y/X)

Naïve Bayes

It is based on Byes theorem of probability. It uses bag-of-words method to extract features. It assumes features are independent.

P(label/feature)=P(label)*P(feature/label)/P(feature)

Maximum Entrophy

Using encoding it converts labelled features into set of vectors [8]. This vector is used to calculate weight of features which is in turn used to predict label.

Bayesian Network

It assumes there is strong relationship is there between features. It is an expensive model so it is not used frequently.

(C)Hybrid approach

It is a combination of lexicon based approach and machine learning based approach for opinion mining.

5. TOOLS USED FOR SENTIMENT ANALYSIS

The following tools are used in sentiment analysis.

(A)NLTK

It is a toolkit used to perform NLP functions and operations. It is based on python. Python is needed to be installed before installing NLTK.

(B)SPACY

It is the competitor for NLTK. It is based on Cython. It is for large scale data collection. It is the best tool to prepare data for deep learning.

(C)Word vector

It is vectors of numbers represent synonym of a word. It represents words as multidimensional continuous floating point numbers. It is a row of real valued numbers and synonyms has similar vectors.

CONCLUSION

This paper explains about the sentiment analysis. The levels of sentiment analysis, the various methods available for doing sentiment analysis are explained here. This also shows features of algorithms used in various methods.

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Small Cell Base Station Switch On/Off In Heterogeneous Network Using IoT

S.Vijayasanthi

Abstract:

In this paper, we address the deployment of small cells in the future radio access network 5G.We propose our new and original switch ON/OFF mechanism for small cells base stations based on Low Power Wide Area Networks (*LPWAN*). Our proposal aims to completely shut down the small cell in heterogeneous networks during low traffic periods. We carry out the wake-up process using a connected Internet of Things (*IoT*) object based on a Long Range(*LoRa*) system dedicated for Internet of Things applications. Furthermore, we present our proposal of providing an energy efficient backhaul for the small cell based on the deployment of Mesh routers. These routers are based on our original mechanism that we called start and stop which also allows a Reducing of the energy consumed requested to insure the backhauling.

Keywords:- Switch ON/OFF, Small cells, IoT, Energy Efficiency.

I.INTRODUCTION:

A small cell is basically a tiny base station that breaks up a cell site into much smaller pieces, and is a stretch that involves pico cells, micro cells, femtoa cells and can embrace of indoor/outdoor systems.

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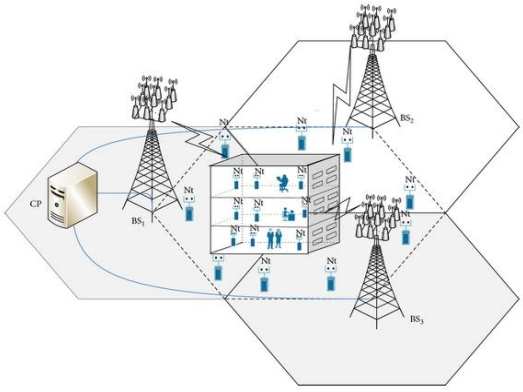
With a macro base station, there's one cylinder going into the grid; with small cells, it disruptions the cylinder into many cylinders. The main objective of small cells is to intensification the macro cell's edge data capacity, speed and overall network efficiency.[1]

Small cells were added in Release 9 of the 3GPP LTE spec in 2008, and are one element of network densification, or adding more base station connections to the existing wireless infrastructure.

GO IN DEPTH

- HetNet/Small Cells (3GPP)
- 5G Exposed! (Electronic Design, Apr. 2017)

Small cells are naturally used in very securely populated urban areas, such as bargain chasing centers, leisure venues, airdromes and train stations – basically anyplace you have a lot of people using data at a given point in time. Most small cell infrastructure deployments are targeted for outdoor use today. In contrast, indoor small cell systems may or may not combine Wi-Fi or unrestrained LTE bands (LTE-U)/Licensed Assisted Access (LAA), provisional on the capabilities that service providers want to support.[1]



1.1 Performance analysis of 3D massive MIMO cellular systems with collaborative base station.

2.SMALL CELLS FIT INTO THE 5G REVOLUTION:

5G will provide improved data capacity, lower latency and longer battery life.

- 5G will not interchange 4G; it simply facilitates a larger diversity of applications that 4G cannot perform. 4G grids such as small cells will linger to advance in analogous with 5G. (See figure below.)
- 5G NR (new radio) grids are not predicted to be effective until at least 2020, which mean 5G mobile devices will not confirmation up until after 5G networks are amalgamated.Small cells help in this pre-5G/LTE-Advanced Maven (LTE-A Pro) growthsince they:[2]
- Deliver improved data capacity.
- Help service providers eliminate expensive gable arrangements and setting up or hire costs, which reduces the overall cost
- Help improve the performance of mobile handsets. If your phone is closer to a small cell base station, it transmits at lower power levels, which effectually lowers the power out of the cell phone and substantially increases its battery life.

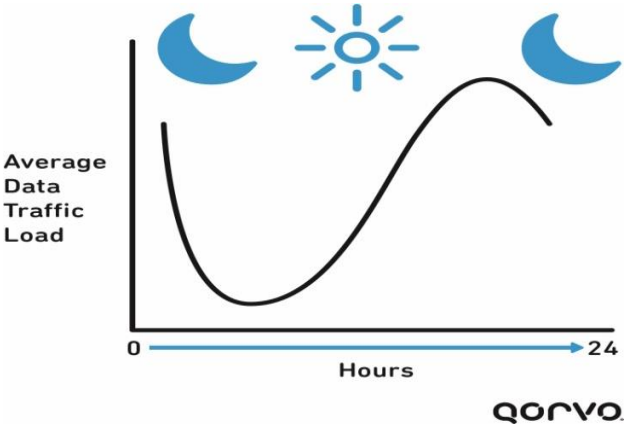
There's presently a lot of discussion that true 5G will operate at cultured frequency bandwidths, such as 28 GHz or 39 GHz. Small cells will also be critical at these millimeter wave (mm Wave) regularities because the signals cannot penetrate walls or houses and the cell sizes will have analysis radius of less than 500 meters. Years down the road, there may be an overlay for those 5G networks, on top of the systems used for small cells today.[3]

1G	2G	3G	4G	5G
1981	1992	2001	2010	2020(?)
2 Kbps	64 Kbps	2 Mbps	100 Mbps	10 Gbps
Basic voice service using analog protocols	Designed primarily for voice using the digital standards (GSM/CDMA)	First mobile broadband utilizing IP protocols (WCDMA / CDMA2000)	True mobile broadband on a unified standard (LTE)	'Tactile Internet' with service-aware devices and fiber-like speeds
				?

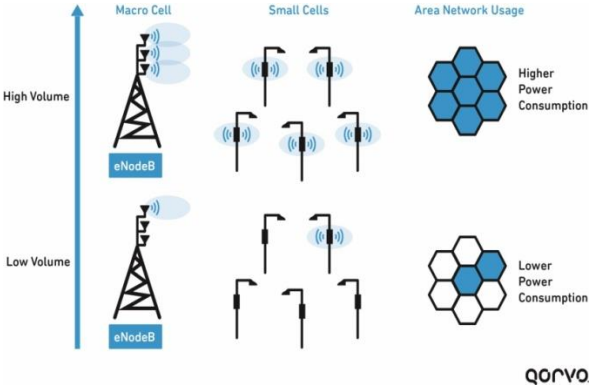
3. ENERGY EFFICIENT SOLUTIONS IN BASE STATIONS:

Base stations have been designed to address peak capacities, minimizing downtime and optimizing user experience. But in reality, networks that are energy efficient at heavy load conditions are far less efficient-per-bit at lower load conditions.

As it turns out, it is very common during any given 24-hour period for a cellular network's load to be low, rather than at its peak - daily load levels are very uneven.[3]



A good portion of the time, a small amount of user data is being transmitted, and reducing power consumption during these low traffic times —using adaptive radio network designs — will significantly lower operator costs and CO_2 emissions. Techniques such as protuberance muting (multi-antenna spreads stimulated when there is user histories to transmit), network small cell deployments, and power-saving mode radio network enhancements are just a few ways to aid in the reduction of power consumption.



Power-saving modes can extend from minutes to hours, and are very effective in reducing power consumption. This form of power reduction reduces power consumed, as well as radiated heat from the radio. The challenge with powering down the radio is waking it up. Waking up the radio may not be instantaneous; therefore, radio designers need to mitigate any latency impacts and network disruptions.

The introduction of small cells helps lower network operating costs, as these smaller base station designs are passively cooled, provide network edge coverage, and operate at a much lower radio power. The benefits to the user are increased battery life and capacity, due to the shorter propagation and close proximity to the mobile device. The benefit to the operator is the ability to add needed capacity to specific hot spots, optimizing energy cost.[4] Carriers can choose from several varieties of small cells (Femto cell, Pico cell, or Microcell, for example) depending on power level and range requirements, keeping power levels at a minimum while providing higher quality connections with higher throughput and lower latency.

Macro base stations are also becoming much more efficient. The robustness and reliability of active radio components have increased dramatically over the last decade, enabling all outdoor tower-top installations using remote radio head units. Remote radios require only passive cooling and minimize feed losses due to their proximity to the antenna. By reducing feed losses, the transmitter can be half the power and still deliver the

same performance at the antenna. In addition, the receiver noise figure is improved, and the mobile unit can transmit less power for the same signal-to-noise ratio. [5]

Base station architectures also are changing, supporting massive multiple-input multiple-output (MIMO) with full-dimensional adaptive beam forming, termed FD-MIMO by the 3GPP standards community. FD-MIMO systems employ a large number of active transceivers, individually feeding antennas arranged in a closely spaced two dimensional array.

Up to 64 transmit and receive chain systems are being field tested and standardized in LTE-Advanced Release 13. The additional degrees of freedom allow improved inter-user interference mitigation, capacity gains, and beam forming in both the horizontal and vertical planes. [6]

4. CONCLUSION

In this paper, the multi objective problem of simultaneously maximizing EE and small cell of an uplink of a two-tier OFDMA based Het Nets with maximum input power constraint is solved. At first, the problem is converted into an SOP and then is solved using a two layer optimization approach in which the outer layer is solved by Dikelbach method (as shown in AlgorithmI) whereas the inner layer is solved using LDD approach (as shown in Algorithm-II). Due to the quasi-concavity nature of the proposed approach, the global optimal solution is derived using LDD.

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Communicating Marine Trained Worker Victimization Wi-Fi with Multilevel Purpose to Purpose Communication Using Backhaul Network

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Abstract

Nowadays, wireless communications are more and more important to the development of the society, not only in land, but also in the sea. When discussing about communications in maritime environments the scenario is different and harder, because of several factors, such as, the movement on the surface of the sea. When the fishermen leave the shore, they have to face various hazardous oceanographic and climatic conditions. There is no proper communication network for the fisherman at sea. There is no coverage and connectivity as they go farther into the sea. Offshore internet access is a big help to the marine fishermen who spend more than 10 days in the oceans on a single fishing trip. We have successfully developed and prototyped a novel and affordable communication network for marine fishermen. The network employs an opportunistic multi-level point-to-multi-point backhaul network architecture using long range (LR) Wi-Fi and distance calculation algorithm.

Keywords: Wireless communication, Marine fisherman, Effective Communication

1. INTRODUCTION

Mobile Ad-hoc Network (MANET) is a communication paradigm where several mobile wireless devices can dynamically form a network to exchange information with each other using own networking resources. Due to this decentralized nature, MANET is widely studied to deploy network where infrastructure based network deployment is complex and cost prohibitive according to application purposes. The Vehicular Ad-hoc Network (VANET) is one of the frequently studied applications of MANET [1]. These VANETs are costly implemented for terrestrial environment. But, researchers currently argue that MANET has also great potentiality to deploy communication systems with marine vehicles. However, marine fishing is a dangerous activity that involves a fairly high level of risk. When the fishermen leave the shore, they have to face various hazardous oceanographic and climatic conditions. There is no proper communication network for the fisherman at sea. There is no coverage and connectivity as they go farther into the sea. Due to this, when fishing vessels collide with ships, the news of the disaster does not reach the shore quickly, sometimes not at all. Similarly any other emergency information cannot be passed to the shore by the fishermen. Alert information regarding occurrence of any storms or cyclones at sea cannot be conveyed to the fishermen from the shore. In some cases we can prevent a disaster if there is proper communication among fishermen on different boats

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or between fishermen and shore. In addition, staying connected with their families will also boost the psychological wellbeing of the fishermen during their multi-day Sea trips. With sufficient bandwidth availability, several digital services for the fishermen's welfare can also be rolled out [2]. All these factors make the extension of internet connectivity into the sea so important. The range of cellular networks over the sea area is limited to about 15 km from the shore. So communication over the seas is very essential especially during emergency conditions. To solve the various problems faced by the fishermen, our research centre took up the research in development of marine communication infrastructure for coastal fishermen. The aim of the project is to provide an effective and reliable way for the fishermen to communicate amongst themselves and with the shore during emergencies and other times using text/email messages and/or voice calls. Based on a survey conducted among fishermen, we came to know that almost all the fishermen have smart phones, so we came up with a Wi-Fi based solution that was affordable to the boat owners. We also came to know that the boats are usually present about 15 - 20 km apart from each other in maritime wireless networks the received signal strength is subjected to perturbations due to the sea movement [3]. The main point is not how to build new technologies, but how to adapt existing ones to handle with specific maritime communications characteristics. Since it is almost impossible to predict maritime conditions, people usually face weak and unstable communications when they are in the sea. The movement of the sea caused by sea waves affects ships with communications equipment, causing variations to the communication antenna's height and orientation, affecting the antenna gain and the overall quality of the link. This makes the quality of maritime connection link experience periodic degradation, increasing the number of packets retransmissions and provoking long delays. The movement behaviors of fishing boats are different to the behaviors of any other entities and depend on the fishing activities [4, 5]. The fishing activities happen at the different times of the day. Most of the netting is done during the night, yet some netting is done in the day time due to fishing regulation for a specific region and behavior of the target species. The fishing boats usually initiate trips in the evening and return in the morning after finishing their fishing trips. The distribution of fishing activities also varies according to the species stock and the seasons in a given year.

2. LITERATURE REVIEW

Mehta, Mirav T [6] Current technology assistance to Indian Fishermen for coastal communication consists mainly of handheld radios, which only enables broadcast communication over a short range. In order to overcome these limitations, a cost effective marine communication infrastructure based on long range Wi-Fi backhaul, called OceanNet, and has been developed at our research centre, where fishermen would be able to have Internet access until 60 km. This work aims to carry out traffic analysis and modelling of this marine communication network for Fishermen, Ocean Net. This exercise will help us model and understand the behaviour of the network, once it is scaled up when the Ocean Net deployment is done on several boats and the number of end user devices (smart phones and tablets) increases. It will also help us to identify bottlenecks in the network and identify ways to overcome these

bottlenecks. This work is based on real world traffic data collected from the field trials conducted over the Arabian Sea and an experimental network set up over the backwaters.

Kazdaridis, Giannis, et al [7] In this paper a novel architecture for enabling on-line communication with marine environment monitoring deployments. We rely on a set of communication technologies that range from IoT related low data rate communication standards to the widely adopted Wi-Fi and LTE protocols that are able to support bandwidth demanding applications. To achieve energy-efficient results we turn off all the power-hungry interfaces and peripherals, while maintaining a low-power interface active, dedicated to control the rest of the components. Finally, we present the installation of the developed system in the Vida oceanographic buoy, in Slovenia and evaluate our device in terms of power consumption.

Sahu, Sanjay Kumar [8] Numerical simulations using a more sophisticated Monte-Carlo technique show that the channel characteristics of an underwater optical wireless communication (UOWC) system are sensitive to angular scattering properties of marine particles (i.e., shape of the phase function), especially in the forward angles (0°-90°). Results of this study include power budget and channel impulse response estimated using different phase functions (Petzold, OTHG, TTHG and SS) and other optical parameters for the cases of harbor waters. Comparison of these results establishes the importance of using an accurate phase function in channel modeling of UOWC systems. Furthermore, comparison with the model based on Beer's law establishes the advantage of considering the finite probability of receiving scattered photons at the receiver end. Our finding reveals that estimation of power loss considering extinction coefficient as in Beer's law severely underestimates the received power, leading to shorter communication range especially in turbid harbor waters.

Vijayan, Deepthy M. [9] communication link between fishing vessels or with the sea shore using Wi-Fi is explored in this paper. For effective communication a high gain antenna is mounted at the sea shore which acts as base station (BS). Although narrow band directional antenna used in the Base Station (BS) ensures the connectivity for a long distance, the coverage will be poor without any steering mechanism, as the antenna beam is fixed in a particular direction. The proposed smart antenna with adaptive beam forming and multiple access technique can ensure the coverage without losing connectivity at long distance. The main objective is to find the Direction of Arrival (DoA) of the received signal from the fishing vessel moving at a constant velocity for adaptive steering of the antenna beam. The DoA parameter gives the phase and amplitude of the signal transmitted from the fishing vessel. The same phase and amplitude help to calculate the beam forming vectors in the smart antenna and it adaptively steers the beam towards fishing vessel. This paper describes how DoA estimation can apply to a beam forming Wi-Fi antenna array which is used for marine communication, and give a mathematical model of DoA estimation.

Roy, Retsy Ann [10], Wireless data communication along with data classification techniques has got wider acceptance in various marine wireless applications. This paper exploits the power of machine learning algorithm to classify wireless communication dataset for effective

decision making in marine sector. Fishing is among the most risky of professions in the world because once out on the sea, the fishermen are subject to various oceanographic conditions. The unreliable communication between the fishing fleets and to the shore is a serious problem when they face emergency situations like bad weather, border attacks, natural calamities etc. This paper is intended to develop an algorithm to determine the most influential parameters by considering signal strength, wind speed etc. which helps to track, classify and disseminate information to the fishing fleets while they are in deep sea. A decision tree based classification is proposed to find the best node based on the signal strength and the environmental conditions and the scenario has been simulated using NS2 platform. An ensemble based learning algorithm with bagging and adaptive boosting in C4.5 is also employed for improving the performance. The performance comparison has been done and the result shows that the boosted decision tree algorithm has got highest classification accuracy of 95.73%.

3. PROBLEM STATEMENT

Fishermen usually spend an average of 4–6 days at sea, travelling up to 120 km away from sea shore to obtain optimum profits. One of the major problems faced by Indian fishermen is lack of communication with the shore. Cellular connectivity is available only within 15 km from the shore [11]. Other means of communication such as satellite radio are very expensive and getting any spectrum is subject to Government regulations. The technology assistance to Indian Fishermen for coastal communication consists mainly of handheld radios, which only enables broadcast communication over a short range.

4. PROPOSED WORK

To solve the various problems faced by the fishermen, our research center took up the research in development of marine communication infrastructure for coastal fishermen. The aim of the project is to provide an effective and reliable way for the fishermen to communicate amongst themselves and with the shore during emergencies and other times using text/email messages and/or voice calls. The solution employs an opportunistic multi-level point to multi point backhaul network using long range (LR) Wi-Fi. The network is anchored at a base station with a sector antenna on the shore at an elevation of 50-60 meters. A boat houses a customer premises equipment (CPE) that acts as a gateway to the backhaul network and also a Wi-Fi access router, known as Fisher Mesh router (FMR), to which the Wi-Fi enabled devices (smart phones, tablets, etc.) on the boat can connect. The CPE and the FMR on a boat are connected over Ethernet. An onshore Network Operations Center (NOC) is used to manage and monitor the network. A cluster of boats can also form a Wi-Fi mesh network using their FMRs. Every boat in a cluster will have an FMR and a subset of boats will also have a CPE. The CPE on a boat can be opportunistically reconfigured to act as a mobile base station to extend the network range to some extent. Note that we could have multiple levels of such opportunistic range extension based on a mobile base station. Both the backhaul network and the access network can operate at either 2.4 GHz or 5 GHz ISM band. Using this setup we had conducted two field trials, one each with the backhaul network operating at 5.8 GHz and 2.4 GHz respectively. The trails were conducted in the Arabian Sea from the sea coast in a small village in the state of Kerala in south west India.

The base station was located at a height of 56m from the sea level on top of a tall building on the shore. This paper presents a comprehensive comparative study of the results obtained. It maps the coverage area of the base station with the attainable data rates at various distances from the base station [12, 13]. This is done using a combination of field trial results and data sheets. Based on this analysis, 2.4 GHz is the preferred option as it provides longer range and higher data rates when compared to 5 GHz. These are all done by calculating the distance.

DISTANCE CALCULATION ALGORITHM

Every boat will be having on-boat GPS device for finding its location. So, using the GPS device, every boat will be getting its location co-ordinates (latitude and longitude co-ordinates). The maritime border for a country is always fixed and constant. Also, the border is not a straight line, which will be a well-defined imaginary curve through the sea (Figure 3). When a CPE associates with a base station, it will get the maritime border segment corresponding to that region as an array of coordinates. Thus by knowing the maritime border co-ordinates and its current location co-ordinates, a boat will calculate its displacement from the maritime border by doing a binary search of the array of maritime border coordinates [14, 15]. The algorithm is described below: a) Initially, choose the coordinates of the middle element of the array of border co-ordinates and calculate the distance from the co-ordinate to the boat. b) Then, choose the immediate left and right co-ordinate points of the middle element and calculate the distance to those points. c) If the distance of any one side is lesser, then continue with that half of the border. d) Take the selected half as the whole border to be considered and perform steps (a) to (c) until the time you are left with an array size of 1 or 2 for the border. e) If the array size is 1, calculate the distance of the boat from that point. If there are two points in the array, take the mean of the two distances.

BACKHAUL NETWORK

The system uses standard Wi-Fi in the access network and multi-level LR Wi-Fi point-to-multi-point links in the backhaul network. A standard Wi-Fi access point provides connectivity to Wi-Fi enabled devices such as smart phones and tablets on the boat. Boats tend to form clusters in the fishing zones naturally. The access points on the boats within a cluster can form a mesh network amongst themselves. We refer to the access point as Access Router (AR) since it handles the routing of packets within the mesh network. A sub-set of these ARs are connected to a Customer Premises Equipment (CPE) on the same boat over Ethernet. The CPE forms a LR Wi-Fi link to the base station.

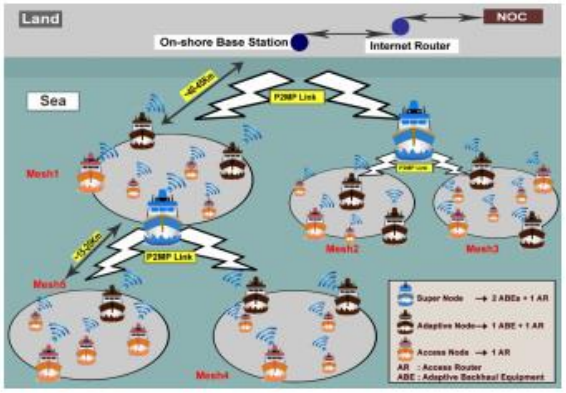

Figure 1: Proposed Architecture

The base station has a sector antenna providing a point-to-multi- point backhaul link. Multiple CPEs can connect to the base station. The CPE is also capable of playing the role of a mobile base station. We refer to the

CPE as Adaptive Backhaul Equipment (ABE) [16]. A sub-set of ABEs can be dynamically configured to act as mobile base stations. These mobile base stations provide a second level point-to-multi-point backhaul network and serve to extend the range further. In this manner, the range can be extended by multiple levels of point-to-multi- point networks by using boats as mobile base stations.

5. CONCLUSION

Marine fishermen community all over the world face a real problem when they have to spend more than 10 days or more at a time in the middle of the ocean with no cost-effective means of contacting the mainland. This is more so in the developing countries where the financial constraints of this community are even more acute. In this paper we have found a viable economical solution to this problem using an innovative and unique network architecture that uses long range Wi-Fi for backhaul network by using long range (LR) Wi-Fi and distance calculation algorithm to provide a better communication in that region.

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Complement and μ-Complement of Intuitionistic Fuzzy Soft Graph

T. Kiruthika

Abstract

In this paper, the basic definitions of intuitionistic fuzzy soft graph, strong and complete intuitionistic fuzzy soft graph are introduced. The notions of complement and μ-complement of intuitionistic fuzzy soft graph are introduced and also some of their properties are investigated.

Keywords - Intuitionistic fuzzy soft graph, Strong IFSG, Complete IFSG, μ-Complement IFSG.

1. INTRODUCTION

In 1999, Soft set theory is applied to smooth of functions, game theory, operations research, probability and measurement theory by Molotov[1,2]. The notions of soft trees, soft cycles, soft bridges, soft ctnodes and describe a various methods of construction of soft trees are discussed by Akram and Nawaz [3].

The concept of soft set theory to solve imprecise problems in the field of engineering, social science, economics, medical science and environment are discussed Molodstov [4] in 1999. Molodtsov [4,5] applied soft set theory to several directions. In recent times, a number of researchers were more active doing research on soft set. Anas AI-Masarwah, Majdoleen Abu Qamar [6] discussed about the complement of fuzzy soft graph and isolated fuzzy soft graph. A.M.Shyla and T.M.Mathew Varkey [7] discussed strong and complete intuitionistic fuzzy soft graph. In this paper the author discussed about the μ-complements of intuitionistic fuzzy soft graph.

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2. PRELIMINARIES

Definition 2.1

A pair (F,A) is called fuzzy soft set over U, where F is a mapping given by F :A$\rightarrow F^U$; F^U denotes the collection of all fuzzy subsets of U; A$\subseteq P.$

Definition 2.2

Let G= (V,E) be a simple graph, V= $\{v_1, v_2 \ldots v_n\}$ (non-empty set), E$\subseteq V\times V$, P (parameter set) and $A\subseteq P$ .Also let

1. μ_i is a function defined on V by

$\mu_i : A\rightarrow F^U(V)$ ($F^U(V)$ denotes collection of all fuzzy subsets in V)

a$\mapsto \mu_i(a)=\mu_{ia}$ (say) , a$\in A$ and $\mu_{ia}:V\rightarrow[0,1]$, $v_i\mapsto\mu_{ia}(v_i)$

(A, μ_i) fuzzy soft vertex and

2. μ_{ij} is a function defined on E by

$\mu_{ij} : A \to F^U(V \times V)$ ($F^U(V \times V)$ denotes collection of all fuzzy subsets in E)

$a \mapsto \mu_{ij}(a) = \mu_{ija}$ (say), $a \in A$ and $\mu_{ija} : V \times V \to [0,1]$, $(v_i, v_j) \mapsto \mu_{ija}(v_i, v_j)$

(A, μ_{ij}) fuzzy soft edge.

A pair ((A, μ_i) ,(A, μ_{ij})) is called a fuzzy soft graph. If $\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$ $\forall$ $(v_i, v_j) \in E$ and $a \in A$

Definition 2.3

A pair ($\breve{F}$,A) is called intuitionistic fuzzy soft set over U, where $\breve{F}$ is a mapping given by the $\breve{F}$:A $\to IF^U$; IF^U denotes the collection of all intuitionistic fuzzy subsets of U; A $\subseteq P$.

Definition 2.4

Let G= (V,E) be a simple graph, V= $\{v_1, v_2 \ldots v_n\}$ (non-empty set), E $\subseteq V \times V$, P (parameter set) and $A \subseteq P$ .Also let

1. μ_i is a membership function defined on V by

$\mu_i : A \to IF^U(V)$ ($IF^U(V)$ denotes collection of all intuitionistic fuzzy subsets in V)

$a \mapsto \mu_i(a) = \mu_{ia}$ (say) , $a \in A$ and $\mu_{ia} : V \to [0,1]$, $v_i \mapsto \mu_{ia}(v_i)$

(A, μ_i) Intuitionistic fuzzy soft vertex of membership function and

ν_i is a membership function defined on V by

$\nu_i : A \to IF^U(V)$ ($IF^U(V)$ denotes collection of all intuitionistic fuzzy subsets in V)

$a \mapsto \nu_i(a) = \nu_{ia}$ (say) , $a \in A$ and $\nu_{ia} : V \to [0,1]$, $v_i \mapsto \nu_{ia}(v_i)$ (A, ν_i) Intuitionistic fuzzy soft vertex of membership function such that $0 \le \mu_{ia}(v_i) + \nu_{1a}(v_i) \le 1$, for every $v_i \in V$, i=1,2,….n and $a \in A$.

2. μ_{ij} is a membership function defined on E by

$\mu_{ij} : A \to IF^U(V \times V)$ ($IF^U(V \times V)$ denotes collection of all intuitionistic fuzzy subsets in E)

$a \mapsto \mu_{ij}(a) = \mu_{ija}$ (say) , $a \in A$ and $\mu_{ija} : V \times V \to [0,1]$, $(v_i, v_j) \mapsto \mu_{ija}(v_i, v_j)$ ν_{ij} is a non-membership function defined on E by

$\nu_{ij} : A \to IF^U(V \times V)$ ($IF^U(V \times V)$ denotes collection of all intuitionistic fuzzy subsets in E)

$a \mapsto \nu_{ij}(a) = \nu_{ija}$ (say) , $a \in A$ and $\nu_{ija} : V \times V \to [0,1]$, $(v_i, v_j) \mapsto \nu_{ija}(v_i, v_j)$ where ((A, μ_{ij}) ,(A, ν_{ij})) are intuitionistic fuzzy soft edge of membership and non-membership function satisfying

$\mu_{ija}(v_i, v_j) \le \min\{\mu_{ia}(v_i), \mu_{ia}(v_j)\}$

$\nu_{ija}(v_i, v_j) \le \max\{\nu_{ia}(v_i), \nu_{ia}(v_j)\}$ and

$0 \le \mu_{ija}(v_i, v_j) + \nu_{ija}(v_i, v_j) \le 1$,

$0 \le \mu_{ija}(v_i, v_j), \nu_{ija}(v_i, v_j) \le 1$, for every $(v_i, v_j) \in E$, i , j = 1,2…. n and a $\in A$

Then $G = (V, E, (A, \mu_1), (A, \gamma_1), (A, \mu_2), (A, \gamma_2))$ is said to be Intuitionistic fuzzy soft graph (IFSG) and this IFSG is denoted by $G_{A,V,E}$.

Definition 2.5

Let $G_{A,V,E}$ be an intuitionistic fuzzy soft graph. It is said to be strong intuitionistic fuzzy soft graph if $\mu_{ija}(v_i, v_j) = \min\{\mu_{ia}(v_i), \mu_{ia}(v_j)\}$ and z $= \max\{\nu_{ia}(v_i), \nu_{ia}(v_j)\}$ for every $(v_i, v_j) \in E$, and a $\in A$.

Definition 2.6

Let $G_{A,V,E}$ be an intuitionistic fuzzy soft graph. It is said to be complete intuitionistic fuzzy soft graph if $\mu_{ija}(v_i, v_j) = \min\{\mu_{ia}(v_i), \mu_{ia}(v_j)\}$ and $\nu_{ija}(v_i, v_j) = \max\{\nu_{ia}(v_i), \nu_{ia}(v_j)\}$ for every $(v_i, v_j) \in V$, and a $\in A$

Definition 2.7

Let $G_{A,V,E}$ be an intuitionistic fuzzy soft graph. The complement of a $G_{A,V,E}$ is defined as

$\overline{G_{A,V,E}} = (V, E, (A, \mu_i), (A, \nu_i), \overline{(A, \mu_{ij})}, \overline{(A, \nu_{ij})})$ where

$\overline{\mu_{ija}}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j)$

$\overline{\nu_{ija}}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i, v_j)$ for all $v_i, v_j \in V, a \in A$.

Definition 2.8

If $G_{A,V,E}$ be an intuitionistic fuzzy soft graph. $G^{\mu}_{A,V,E}$ is a μ- complement of a $G_{A,V,E}$ is defined as $G^{\mu}_{A,V,E} = (V, E, (A, \mu_i), (A, \nu_i), (A, \mu_{ij})^{\mu}, (A, \nu_{ij})^{\mu})$ where $\mu^{\mu}_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j)$

$\nu^{\mu}_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i, v_j)$ for all $v_i, v_j \in V, a \in A$.

3. MAIN RESULTS OF IFSG

THEOREM 3.1

If $G_{A,V,E}$ be an intuitionistic fuzzy soft graph. Then $G_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph if and only if $\overline{G_{A,V,E}}$ is a strong intuitionistic fuzzy soft graph.

Proof

Given $G_{A,V,E}$ be an intuitionistic fuzzy soft graph. The complement of a $G_{A,V,E}$ is defined by $\overline{G_{A,V,E}}$

$\overline{\mu_{ija}}(v_i, v_j) = 0$ $\overline{\nu_{ija}}(v_i, v_j) = 0$ for all $v_i, v_j \in V \times V, a \in A$.

Since

$\overline{\mu_{ija}}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j)$ for all $v_i, v_j \in V \times V, a \in A$.

$\overline{\mu_{ija}}(v_i,v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$ for all $v_i,v_j \in V \times V, a \in A$.

$\overline{\nu_{ija}}(v_i,v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i,v_j)$ for all $v_i,v_j \in V \times V, a \in A$.

$\overline{\nu_{ija}}(v_i,v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j)$ for all $v_i,v_j \in V \times V, a \in A$.

$\overline{\mu_{ija}}(v_i,v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$, $\overline{\nu_{ija}}(v_i,v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j)$ for all $v_i,v_j \in V \times V, a \in A$.

Hence $\overline{G_{A,V,E}}$ is a strong intuitionistic fuzzy soft graph.

Conversely,

Given $\overline{G_{A,V,E}}$ is a strong intuitionistic fuzzy soft graph.

$\overline{\mu_{ija}}(v_i,v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$,

$\overline{\nu_{ija}}(v_i,v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j)$

for all $v_i,v_j \in V \times V, a \in A$.

Since

$\mu_{ija}(v_i,v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \overline{\mu_{ija}}(v_i,v_j)$

for all $v_i,v_j \in V \times V, a \in A$.

$= \overline{\mu_{ija}}(v_i,v_j) - \overline{\mu_{ija}}(v_i,v_j)$

for all $v_i,v_j \in V \times V, a \in A$.

$\mu_{ija}(v_i,v_j) = 0$ for all $v_i,v_j \in V \times V, a \in A$.

$\nu_{ija}(v_i,v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \overline{\nu_{ija}}(v_i,v_j)$

for all $v_i,v_j \in V \times V, a \in A$.

$= \overline{\nu_{ija}}(v_i,v_j) - \overline{\nu_{ija}}(v_i,v_j)$

for all $v_i,v_j \in V \times V, a \in A$.

$\nu_{ija}(v_i,v_j) = 0$

for all $v_i,v_j \in V \times V, a \in A$.

$\mu_{ija}(v_i,v_j) = 0$ and $\nu_{ija}(v_i,v_j) = 0$

for all $v_i,v_j \in V \times V, a \in A$.

Hence, $G_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph.

THEOREM 3.2

If $G_{A,V,E} = (V,E,(A,\mu_i),(A,\nu_i),(A,\mu_{ij}),(A,\nu_{ij}))$ be an intuitionistic fuzzy soft graph. Then $G^{\mu}_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph if and only if $G_{A,V,E}$ is a strong intuitionistic fuzzy soft graph.

Proof:

Given $G_{A,V,E} = (V,E,(A,\mu_i),(A,\nu_i),(A,\mu_{ij}),(A,\nu_{ij}))$ be an intuitionistic fuzzy soft graph. The μ-complement of $G_{A,V,E}$ is denoted by $G^{\mu}_{A,V,E}$. Let $G_{A,V,E} = (V,E,(A,\mu_i),(A,\nu_i),(A,\mu_{ij}),(A,\nu_{ij}))$ be an strong intuitionistic fuzzy soft graph. If

$\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$ and $\nu_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j)$ $\forall (v_i, v_j) \in E$ and $a \in A$ otherwise

$\mu_{ija}(v_i, v_j) = 0$ and $\nu_{ija}(v_i, v_j) = 0$

By the definition of μ-complement and from equations (1) and (2)

$\mu^{\mu}_{ija}(v_i, v_j) = 0$ and $\nu^{\mu}_{ija}(v_i, v_j) = 0$ $\forall (v_i, v_j) \in E$ and $a \in A$

Hence, $G^{\mu}_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph.

Conversely,

Assume $G^{\mu}_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph.

For a membership function

$\Rightarrow \mu^{\mu}_{ija}(v_i, v_j) = 0$ $\forall (v_i, v_j) \in E$ and $a \in A$

$\Rightarrow \mu^{\mu}_{ija}(v_i, v_j) = 0$ $\forall (v_i, v_j) \in \mu^*$ and $(v_i, v_j) \notin \mu^*$ $a \in A$

From the definition if $(v_i, v_j) \in \mu^*$

$\mu^{\mu}_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j)$

Since $\mu^{\mu}_{ija}(v_i, v_j) = 0$

$0 = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j)$ $\forall (v_i, v_j) \in E$ and $a \in A$

$\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$ $\forall (v_i, v_j) \in E$ and $a \in A$

For a non-membership function

$\Rightarrow \nu^{\mu}_{ija}(v_i, v_j) = 0$ $\forall (v_i, v_j) \in E$ and $a \in A$

$\Rightarrow \nu^{\mu}_{ija}(v_i, v_j) = 0$ $\forall (v_i, v_j) \in \nu^*$ and $(v_i, v_j) \notin \nu^*$ $a \in A$

From the definition if $(v_i, v_j) \in \nu^*$

$\nu^{\mu}_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i, v_j)$

Since $\nu^{\mu}_{ija}(v_i, v_j) = 0$

$\Rightarrow 0 = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i, v_j)$ $\forall (v_i, v_j) \in E$ and $a \in A$

$\Rightarrow$

$\nu_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j)$ $\forall (v_i, v_j) \in E$ and $a \in A$

Therefore,

$\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$ and $\nu_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j)$ $\forall (v_i, v_j) \in E$ and $a \in A$

Hence,

$G_{A,V,E} = (V, E, (A, \mu_i), (A, \nu_i), (A, \mu_{ij}), (A, \nu_{ij}))$ be an strong intuitionistic fuzzy soft graph.

THEOREM 3.3

If $G_{A,V,E} = (V, E, (A, \mu_i), (A, \nu_i), (A, \mu_{ij}), (A, \nu_{ij}))$ be an intuitionistic fuzzy soft graph. Then $G^{\mu}_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph if and only if $G_{A,V,E}$ is a complete intuitionistic fuzzy soft graph.

Proof

Given $G_{A,V,E} = (V, E, (A, \mu_i), (A, \nu_i), (A, \mu_{ij}), (A, \nu_{ij}))$ be an intuitionistic fuzzy soft graph. The μ-complement of $G_{A,V,E}$ is denoted by $G^{\mu}_{A,V,E}$. Let $G_{A,V,E} = (V, E, (A, \mu_i), (A, \nu_i), (A, \mu_{ij}), (A, \nu_{ij}))$ be an strong intuitionistic fuzzy soft graph. If

$$\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) \text{ and } \nu_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) \; \forall (v_i, v_j) \in E \text{ and } a \in A \text{ otherwise}$$

$$\mu_{ija}(v_i, v_j) = 0 \text{ and } \nu_{ija}(v_i, v_j) = 0$$

By the definition of μ-complement and from equations (1) and (2)

$$\mu^{\mu}_{ija}(v_i, v_j) = 0 \text{ and } \nu^{\mu}_{ija}(v_i, v_j) = 0 \; \forall (v_i, v_j) \in E \text{ and } a \in A$$

Hence, $G^{\mu}_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph.

Conversely,

Assume $G^{\mu}_{A,V,E}$ is an isolated intuitionistic fuzzy soft graph.

For a membership function

$$\Rightarrow \mu^{\mu}_{ija}(v_i, v_j) = 0 \; \forall (v_i, v_j) \in E \text{ and } a \in A$$

$$\Rightarrow \mu^{\mu}_{ija}(v_i, v_j) = 0 \; \forall (v_i, v_j) \in \mu^* \text{ and } (v_i, v_j) \notin \mu^* \; a \in A$$

From the definition if $(v_i, v_j) \in \mu^*$

$$\mu^{\mu}_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j)$$

Since $\mu^{\mu}_{ija}(v_i, v_j) = 0$

$$0 = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) - \mu_{ija}(v_i, v_j) \; \forall (v_i, v_j) \in E \text{ and } a \in A$$

$$\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j) \; \forall (v_i, v_j) \in E \text{ and } a \in A$$

For a non-membership function

$$\Rightarrow \nu^{\mu}_{ija}(v_i, v_j) = 0 \; \forall (v_i, v_j) \in E \text{ and } a \in A$$

$$\Rightarrow \nu^{\mu}_{ija}(v_i, v_j) = 0 \; \forall (v_i, v_j) \in \nu^* \text{ and } (v_i, v_j) \notin \nu^* \; a \in A$$

From the definition if $(v_i, v_j) \in \nu^*$

$$\nu^{\mu}_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i, v_j)$$

Since $\nu^{\mu}_{ija}(v_i, v_j) = 0$

$$\Rightarrow 0 = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) - \nu_{ija}(v_i, v_j) \; \forall (v_i, v_j) \in E \text{ and } a \in A$$

$\Rightarrow$

$\nu_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) \; \forall \; (v_i, v_j) \in E$ and $a \in A$

Therefore, $\mu_{ija}(v_i, v_j) = \mu_{ia}(v_i) \wedge \mu_{ia}(v_j)$ and $\nu_{ija}(v_i, v_j) = \nu_{ia}(v_i) \vee \nu_{ia}(v_j) \; \forall \; (v_i, v_j) \in E$

and $a \in A$

Hence,

$G_{A,V,E} = (V, E, (A, \mu_i), (A, \nu_i), (A, \mu_{ij}), (A, \nu_{ij}))$ be an complete intuitionistic fuzzy soft graph.

CONCLUSION

In this paper, the definitions of intuitionistic fuzzy soft graphs, complete and strong intuitionistic fuzzy soft graphs are discussed. Also studied about their µ-complement. In future, the author proposed to continue this result in interval-valued intuitionistic fuzzy soft graphs and self-complementary intuitionistic fuzzy soft graphs.

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Smart Elderly People Monitoring System

A.Gandhimathi

Abstract

Security There is a small device that can be integrated into the elderly person as a separate wrist band. This device will alert the family members in case of any mishap as disturbed the elderly person. Use of thermal sensors in integration with motion sensors and CCTVs to detect frequent actions and alerting the nearby hospitals about any possible mishappening. The hospitals on receiving this, will identify the location generated by the system according to the strength of the signal on the particular node. (b) Quality of services there will be an anonymous review portal that can be used to record the feedback given by the elderly person for services like food, water, security, cleanliness, sanitation and wifi. A software which will maintain a record of elderly person and their activities on weekly basis so that the family members can regulate and ensure the problem by the elderly person. The family members will record all the details of the activities along with the approximate medicines to be used. The software will then calculate the available daily activities in the report and will suggest other items which leads to the mishappening of the elders. This will also notify the family member in case of the emergency of any other abnormal disorders. A software and hardware integration can be implemented which will keep a record of elderly person SUGAR and BP and depict the information using charts and pictographs providing actionable information to the concerned authorities on timely basis. This software will also ensure proper functioning of other services.

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INTRODUCTION

The Modern communications systems aims results at high data rates with ubiquitous service performance. The Fingerprint localization techniques are based on Time of Arrival (TOA), Time Difference of Arrival (TDOA), Received Signal Strength Indication(RSSI) and Angle of Arrival (AOA).

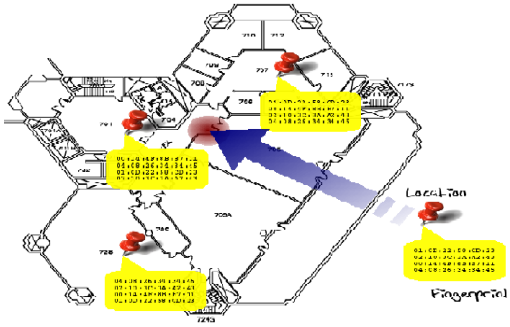

Figure 1: Wireless Sensor Network

So the positioning systems are severely gone down or may get fail all the nodes in indoor environments where the satellite or cellular signals are disturbed, and in order with deep shadowing effects. Algorithms have been proposed to deal with these problems.

Fingerprint positioning has many advantages of existing WLAN to achieve indoor locations, which has been widely studied. The analysis of the corresponding positions

distribution of similar fingerprints, and then found that the fuzzy similarity between fingerprints is the main problem of the larger errors occured. With the effect of clusters distribution feature of corresponding positions of the similar fingerprints, we proposed a K-Means+ clustering algorithm to achieve fine-grained fingerprint positioning. Due to the K-Means+ algorithm failing to locate the positions of outliers, we also documented a linear sequence matching algorithm to make error-free outliers positioning, and to decrease the impact of fuzzy similarity. The Experimental results illustrate that our algorithm can get a maximum positioning error less than 5 m, which overcome other algorithms. So all the positioning errors over 4 m in our algorithm are less than 2%. It improves positioning accuracy significantly. The current researches on fingerprint algorithm mostly focus on two aspects. One is to reduce the cumbersome workload during offline acquisitions, and another is to improve the fingerprint positioning accuracy.

And also a localization algorithm named multi objective particle swarm optimization localization algorithm (MOPSOLA) is approved to solve the multi objective optimization localization errors in wireless sensor networks. The multi objective functions consist of the space distance constraint calculation and the geometric topology constraint calculation. The optimal solution is found by multi objective particle swarm optimization algorithm. Dynamic method is adopted to maintain the archive in order to limit the size of archive, and the global optimum is obtained according to the proportion of selection. The simulation results show considerable improvements in terms of localization accuracy and convergence rate while keeping a limited archive size by a method using the global optimal selection operator and dynamically maintaining the archive.

2. RELATED WORK

Fingerprint positioning with no limit of extra deployment is widely studied. Various methods, such as deterministic KNN, Bayesian estimation Sequential Monte Carlo, support vector machine and neural network are used for improving positioning accuracy. But most of fingerprint algorithms rarely reduce the larger errors caused by the body blocking in order to improve the positioning accuracy.

Figure 2: WLAN (IEEE 802.11)

This midrange wireless local area network (WLAN) standard, operating in the 2.4-GHz Industrial, Scientific and Medical (ISM) band, has become very popular in public hotspots and enterprise locations during the last few years. With a typical gross bit rate of 11, 54, or 108 Mbps and a range of 50–100 m, IEEE 802.11 is currently the dominant local wireless networking standard. It is, therefore, appealing to use an existing WLAN infrastructure for indoor location as well, by adding a

location server. The accuracy of typical WLAN positioning systems using RSS is approximately 3 to 30 m, with an update rate in the range of few seconds.

FINGERPRINT FUZZY SIMILARITY AND POSITIONING PERFORMANCE

1.1 Body Blocking Influence.

To analyze the WiFi signal fingerprints positioning performance, we first conduct a study on the impact of various factors, such as orientation and holding position. Due to the development of smart phones, people use the mobile phone to obtain indoor positioning ser-vices increasingly. So we select a GALAXY Note 3 as the WiFi terminal device to acquire signal data. The test mainly studies the multipath and shadow influence on the WiFi signal fingerprint without considering the factor of device diversity. The testbed is an open lab area of 38 m ∗ 26 m. Because the desks and chairs cover some parts of indoor office area, we just choose the 76 positions in the passable region (e.g., corridors) to sample signal fingerprint. There are 8 APs deployed for measurement as shown in Figure 1. At each sampling point, the user faces 0◦ , 90◦ , 180◦ , and 270◦ directions and holds the bottom and upper positions of mobile phone, respectively, to measure signal strength. Each measurement acquires 15 groups of signal strengths to calculate an average value. Thus we will generate a total of 608 records in the offline fingerprint database. Generally, wireless signal strength will change with time leading to some measurement errors [15]. Suppose that these measurement errors follow zero mean normal distri-bution with ε variance. Fingerprint matching often uses the Euclidean distance to measure the similarity of fingerprint vectors, and then the maximum measurement error emax between fingerprints could be calculated by the following equation:

$$n2emax = \sqrt{\sum_{i=1} [(r\,i + \varepsilon) - (r\,i - \varepsilon)]} = 2\varepsilon\sqrt{n}, \quad (1)$$

where ε is the variance of signal strength distribution, r i is the received signal strength from ith AP, and n is the number of APs. Only when the distance of two fingerprint vectors is greater than emax will there be significant fingerprint dissim-ilarity, which is called fingerprint granularity in this paper. Since error ε is the inherent error from signal measurement, we call emax the maximum intrinsic fingerprint granularity error. To analyze the influence on fingerprint granularity and positioning performance with different orientations and holding positions on mobile phone, we design four group tests using the 608 fingerprint records to evaluate orientation and holding position. We select 30 sampling points of the 76 points in Figure 1 to execute 5 times KNN algorithm to com-pute the average value of the positioning errors. Meanwhile, compute the Euclidean distances between 608 fingerprints to construct the fingerprint granularity distribution. In Figure2, different orientation tests include the comparison between 0◦ orientation fingerprints and 90◦ orientation fingerprints and between 0◦ orientation fingerprints while holding the bottom of mobile device. Different holding positions tests include the comparison between holding bottom and upper position

fingerprints and between holding bottom position fingerprints with 180∘ orientation.

Consider the fingerprint fuzzy similarity problem in the practical application of fingerprint posi-tioning, which uses the existing mobile phone to provide a peer assisted algorithm. They adopt the sound ranging method to measure the distance between mobile users by the microphone and loudspeaker of mobile phone and use the acquired distance relationship between mobile users to constrain the fingerprint positioning results, which can prevent the emergence of larger errors. This method can avoid larger positioning errors, but it requires additional sound-based ranging method which will increase the energy consumption of positioning service. More importantly, the sound-based ranging method is hardly used in noisy public environments. We analyze the distribution features of offline similar fingerprints and find similar fingerprints have a cluster position distribution feature besides the fuzzy similarity. Therefore, we design an efficient clustering method on offline fingerprints to eliminate fuzzy similarity and avoid the restrictions of sound ranging.

3. MOPSOLA

The particle swarm optimization (PSO) algorithm is concerned by many researchers for its fast convergence rate and simple implementation. By using particles to imitate the estimated coordinates of unknown nodes, some methods model the localization problem as a single-objective optimization model with the space distance constraint as the only fitness function. For example, the PSO localization algorithm based on log-barrier constraint function could accelerate the convergence speed and save energy [4], the PSO localization adopting crossover operator and the mutation operator could avoid the premature convergence [5], and the PSO localization algorithm based on quantum mechanics could enhance the global convergence and improve the accuracy [6]. However, it always happens that the results of estimated nodes' localizations meet the space distance constraint without meeting the geometric topology constraint because of ranging errors in some practical applications.

A. Describing of MOPSOLA

3.2.1. Overall Framework.

The framework of the proposed multi objective PSO algorithm includes some key operators such as maintenance of archive, global optimum selection, and the velocity and localization update. The particle population relies on an archive to save Pareto optimal solutions during the iterative process and selecting the global optimum from these solutions, which is the key point that the multi objective PSO is different from the traditional single objective localization. Therefore, the localization issue is modeled as a multi objective optimization model in MOPSOLA, and two operators, which are the dynamic maintenance operator for the archive and the global optimum selection operator based on proportion of selection, are designed to be suitable for the limited energy and the poor computing power of WSN nodes.

(i) In the multi objective function calculation level, functions as formulas are calculated according to all particles, that is, all estimated nodes' coordinates.

(ii) In the individual optimal selection level, the personal optimum selection operator works. Based on the concept of Pareto optimality, the best of each particle is chosen between the particle's current location and its historical best dynamically.

(iii) In the global optimal selection level, the global optimum selection operator works. The proportion of selection is set for each Pareto optimal solution based on intensive distance, and a global optimum for each particle is selected by proportion of selection.

(iv) In the velocity and localization update level, the position and velocity update operator works for all individual particles. The update process is similar to the traditional single objective PSO as

$$V_i(t+1) = \omega V_i(t) + c_1 r_1 (pbest_i - h_i(t)) + c_2 r_2 (gbest - h_i(t)),$$

$$h_i(t+1) = h_i(t) + V_i(t+1), \quad i = m+1, m+2, \ldots, n,$$

where V_i is the velocity of the ith particle, $h_i = (\hat{x}_i, \hat{y}_i)$ is the estimated coordinates of the ith particle vector is the best solution for the ith particle, gbest is the best solution for the population, ω is the inertia weight, c1 and c2 are constants, and t is the iteration time.

(v) In the maintenance of archive level, the archive maintenance operator works. The maximum capacity of archive is set as ArcMax and the archive is dynamically updated according to the density distance in the objective space of the Pareto optimal solution to save the storage space.

CONCLUSION

Fingerprint localization algorithm for WSN experimental result shows that the proposed Algorithm improves the accuracy by at least 50% the target node and the number of neighbor nodes. The maximum positioning error is less than 5m by using this fuzzy similarity elimination algorithm. MOPSOLA also increases the localization accuracy to the minimum extent.

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Bounds for Nil Complementary Domination Number for Intuitionistic Fuzzy Graph

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Abstract

The author determined for some standard intuitionistic fuzzy graph. Here considered the related theorems to nil complementary domination number. The relation between nil complementary domination number and domination number are derived

Keyword: Intutionistic fuzzy graph, complementary nil dominating set, nil complementary domination in intuitionistic fuzzy graph and enclave.

1. INTRODUCTION

In 1999, Atanassov [1] introduced the concept of intutionistic fuzzy relation and intuitionistic fuzzy graphs. Parvathi and Karunambigai [5] introduced the concept of intutionistic fuzzy graph and analyzed its components. Nagoor Gani and Shajitha Begum [11] defined degree, order and size in intuitionistic fuzzy graph and proposed some properties. Somasundaram [9] introduced the concept of domination in intuitionistic fuzzy graph. Parvathi and Thamizhendhi [6] introduced the concept of domination number in intuitionistic fuzzy graph. Tamizh Chelvam [10] analyzed the complementary nil dominating set in the crisp graph. In this paper, nil complementary domination in intuitionistic fuzzy graph is defined and analysed its properties for bound of domination number.

2. PRELIMINARIES

Definition 2.1

A *fuzzy graph* $G=(\sigma,\mu)$ is a pair of functions $\sigma:V\to(0,1)$ and $\mu:V\times V\to(0,1)$, where for all $u,v\in V$ $\mu(u,v)=\sigma(u)\wedge\sigma(v)$.

Definition 2.2

Let $G=(V,E)$ be an *intuitionistic fuzzy graph*, such that

(i) $V=\{v_1,v_2.....v_n\}$ such that $\mu_i:V\to(0,1)$ $\nu_i:V\to(0,1)$ denote the degree of membership and non-membership of the element $v_i\in V$ respectively and $0\le\mu_i(v_i)+\nu_i(v_i)\le 1$ for every $v_i\in V$, (i=1,2,.....n).

(ii) $E\subseteq V\times V$ where $\mu_{ij}:V\times V\to(0,1)$ and $\nu_{ij}:V\times V\to(0,1)$ are such that $\mu_{ij}(v_i,v_j)\le\mu_i(v_i)\wedge\mu_i(v_j)$ and $\nu_{ij}(v_i,v_j)\le\nu_i(v_i)\wedge\nu_i(v_j)$ respectively and $0\le\mu_{ij}(v_i,v_j)+\nu_{ij}(v_i,v_j)\le 1$

Definition 2.3

Let $G=(V,E)$, be an intuitionistic fuzzy graph. The *cardinality* of G is defined to be

$$|G|=\left|\sum_{v_i\in V}\frac{1+\mu_i(v_i)-\nu_i(v_i)}{2}+\sum_{v_i\in V}\frac{1+\mu_{ij}(e_{ij})-\nu_{ij}(e_{ij})}{2}\right|$$

The *vertex cardinality* is defined as

$$|V| = \sum_{v_i \in V} \frac{1+\mu_i(v_i)-\nu_i(v_i)}{2}$$

The *edge cardinality* is defined as

$$|E| = \sum_{e_{ij} \in V} \frac{1+\mu_{ij}(e_{ij})-\nu_{ij}(e_{ij})}{2}$$

Definition 2.4

An intuitionistic fuzzy graph $H' = (V', E')$ is said to be an *intuitionistic fuzzy sub graph* of $G = (V, E)$ if $V' \subseteq V$ and $E' \subseteq E$. That is $\mu_i' \le \mu_i$; $\nu_i' \le \nu_i$ and $\mu_{ij}' \le \mu_{ij}$; $\gamma_{ij}' \le \gamma_{ij}$ for every i,j=1,2,.....n

Definition 2.7

Let $G = (V, E)$, be an intuitionistic fuzzy graph. The *complement of an intuitionistic fuzzy graph* is, denoted by $G = (\overline{V}, \overline{E})$, to be satisfied the following conditions.

(i) $\overline{V} = v$

(ii) $\overline{\mu_i} = \mu_i$ and $\overline{\nu_i} = \nu_i$ for all i=1,2,.....n

(iii) $\overline{\mu_{ij}} = \min(\mu_i, \mu_j) - \mu_{ij}$ and $\overline{\nu_{ij}} = \min(\nu_i, \nu_j) - \nu_{ij}$ for all i,j=1,2,...n

Definition 2.8

Let $G = (V, E)$ be an intuitionistic fuzzy graph. A set $S \subset V$ is said to be an nil complementary dominating set of an intuitionistic fuzzy graph of G, if S is a dominating set and its complement V-S is not a dominating set. The minimum scalar cardinality over all nil complementary dominating set is called a nil complementary domination number and it is denoted by γ_{ncd}, the corresponding minimum nil complementary dominating set is denote by γ_{ncd} -set.

Definition 2.9

Let $S \subset V$ in the connected intuitionistic fuzzy graph $G = (V, E)$. A vertex $u \in S$ is said to be an *enclave* of S if $\mu_{ij}(u,v) < \max(\mu_i(u), \mu_i(v))$ and $\nu_{ij}(u,v) < \min(\nu_i(u), \nu_i(v))$ for all $v \in V - S$. (i.e) $N(u) \subseteq S$.

3. BOUND FOR NIL COMPLEMENTARY DOMINATION IN INTUITIONISTIC FUZZY GRAPH

Theorem 3.1

For any IFG $G = (V, E)$, shows that bound such that $\delta_n + \sigma_0 < \gamma_{ncd} < \gamma + \delta_n + \sigma_n - \sigma_0$

Proof

Claim 1: $\delta_n + \sigma_0 < \gamma_{ncd}$

Let S be the nil complementary domination set of a intuitionistic fuzzy graph $G = (V, E)$. Since $V - S$ is not a dominating set, there exist $u \in S$ such that $\mu_{ij}(u,v) < \min(\mu_i(u), \mu_i(v))$ and $\nu_{ij}(u,v) < \max(\nu_i(u), \nu_i(v))$ for all $v \in V - S$.

Then $N(u) \subset S$

$\Rightarrow |N(u) < S|$

Hence $\delta_n + \sigma_0 < \gamma_{ncd}$

Claim 2: $\gamma_{ncd} < \gamma + \delta_n + \sigma_n - \sigma_0$

Let S_1 be a γ- set of G and let $u \in V$ such that $d_N(u) = \delta_N$. Then u is either in D or in $V - D$.

Case (i): If $u \in D$ then $D \cup N(u)$ contains an enclave.

Therefore $D \cup N(u)$ is an nil complementary domination set in intuitionistic fuzzy graph. Hence $\gamma_{ncd} < \gamma + \delta_n$.

Case (ii): If $u \in V - D$ then at least a vertex $v \in D$ such that $\mu_2[u,v] < \min[\mu_1[u], \mu_1[v]]$ and $\nu_2[u,v] < \max[\nu_1[u], \nu_1[v]]$.

Then $D \cup N(u)$ which contains an enclave. Therefore $D \cup N(u)$ is a nil complementary domination set and $D \cup N(u)$ is an non empty set since $v \in D \cup N(u)$.

Hence $\gamma_{ncd} < D \cup N(u)$

$$= |D| + N(u) - |D \cap N(u)|$$

$$= \gamma + \delta_N + \sigma_n - \sigma_0$$

In both the cases get $\gamma_{ncd} < \gamma + \delta_n + \sigma_n - \sigma_0$

Hence $\delta_n + \sigma_0 < \gamma_{ncd} < \gamma + \delta_N + \sigma_n - \sigma_0$

Theorem 3.2

Let $G = (V, E)$ be a intuitionistic fuzzy graph. If $diam(G^*) = 2$, then $\gamma_{ncd} = \Delta_n + \sigma_n$

Proof

Let $G = (V, E)$ be a intuitionistic fuzzy graph and $diam(G^*) = 2$. Then there exist $u, v \in V$ and $u \neq v$ such that $v \notin N(u)$. Therefore $N(u)$ is a nil complementary domination set of G.

Hence $\gamma_{ncd} = \Delta_n + \sigma_n$.

Theorem 3.3

For any intuitionistic fuzzy graph $G = (V, E)$ if $\gamma = p/2$ then $\gamma_{ncd}(G) = p/2 + \sigma_o$

Proof

Let $G = (V, E)$ be a intuitionistic fuzzy graph and let S be γ- set of G with $\gamma(G) = p/2$. Hence $V - S$ is a γ- set with $|V - S| = p/2$. Choose the vertex $u \in V$ such that $\sigma(u) = \sigma_0$. Now either $u \in S$ or $u \in V - S$. Hence $[(V - S) \cup \{u\}]$ or $S - \{u\}$ is a nil complementary domination set. Then either $D \cup \{u\}$ or $[(V - S) - \{u\}]$ is not a dominating set. Therefore either $D \cup \{u\}$ or $[(V - S) - \{u\}]$ is a nil complementary domination set

Hence $\gamma_{ncd}(G) = p/2 + \sigma_o$.

CONCLUSION

The nil complementary dominating set and its number in intuitionistic fuzzy graph is defined. The bound on this number is obtained for some standard intuitionistic fuzzy graph theorems are related to this concepts are derived in this paper.

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