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# An Inventive Method For Solving Fully Interval Transportation Problem

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**Abstract**

*This paper discusses, the transportation problem (TP) under uncertainty, particularly when parameters are given in interval forms, is formulated. That is the shipping cost, supply and demand parameters are all intervals. And also presents the interval parameters would seem to monitor the capability of fixed charge transportation problem. Furthermore, the solution of the interval transportation problem (ITP) is analyzed.*

**Keywords**: *Transportation problem (TP), fixed charge transportation problem, Interval number, interval transportation problem (ITP)*

## Introduction

The transportation problem (TP) is one of the optimization problems in which objective is to transport at the optimal distribution of the various quantities from several sources to different destinations in such a way that the total transportation cost is minimum. In general, a traditional transportation model consists of an objective function and two kinds of constraints, namely source constraint and destination constraint. Itwasoriginated by Hitchock[1] in 1941, concerning its special structure, for finding optimal solutions to TP different methods are discussed in many papers[2,3] and so far. Chanas et.al [4] discussed possible cases of TP with interval parameter and fuzzy parameters. The fixed charge problem was founded by Hirsch and Dantzing [5] in 1954. Solving the interval transportation problem, researchers have divided the problem into two sub-problems namely, upper and lower level. Firstly, the upper level problem is solved and after that, the lower level problem with upper bound constraints on the decision variables is solved.Sengupta and pal [6] presented a new fuzzy orientation method for solving interval TPs by considering the midpoint and width of the interval in the objective function.A.Akilbashaet.al [7] discussed the usage of mid-width method for independent ITP. M.R.Safi, A.Razmjoo[8]developed two different order relations for interval numbers, two solution procedures. S.M. AbulKalamAzad[9] developed algorithm for the average of total opportunity costs of cells along each row identified as Row Average Total Opportunity Cost (RATOC) and the average of total opportunity costs of cells along each column identified as Column Average Total Opportunity Cost (CATOC).

This paper is structured as follows: In section 2, some basic definition and results were related to real intervals are presented. The next section is discussedan interval TP. In addition, appropriate procedure for fixed cost TP is discussed. In section 4, average total opportunity cost methodis used. Succeeding section a numerical example is given for understanding the solution procedure of the proposed method and finally, the conclusion is given in section 5.

## 2. Preliminaries

The aim of this section is to present some notations, notions and results which are of useful in our further consideration.

Let us denote by I the class of all closed and bounded intervals in *R*. If [*a*], [b] are closed and bounded intervals, then the notation [*a*] = [ $\underline{a}$, $\overline{a}$ ] and [b] = [$\underline{b}$, $\overline{b}$], where $\underline{a}$, $\underline{b}$ and $\overline{a}$, $\overline{b}$ mean the lower and upper bounds of [*a*], [b]. Let [*a*] = [ $\underline{a}$, $\overline{a}$ ] and [b] = [$\underline{b}$, $\overline{b}$] be in I. Then by definition,

(i) [*a*] + [ b] = [ $\underline{a}+\underline{b}$, $\overline{a}+\overline{b}$ ] ∈ I

(ii) [*a*] - [ b] = [ $\underline{a}-\overline{b}$, $\overline{a}-\underline{b}$ ] ∈ I

(iii) - [a] = [ $-\overline{a}$, $-\underline{a}$ ] ∈ I

(iv) $x$ [ $\underline{a}$, $\overline{a}$ ] = [$x\underline{a}$, $x\overline{a}$ ], if $x \geq 0$

[ $x\overline{a}$, $x\underline{a}$ ], if $x \leq 0$

Where $x$ is a real number.

(v) An interval [*a*] is said to be positive, if $\underline{a} > 0$ and negative, if $\overline{a} < 0$.

(vi) If [*a*] = [ $\underline{a}$, $\overline{a}$ ] and also [b] = [$\underline{b}$, $\overline{b}$] are bounded and real intervals, consider the multiplication of two intervals as follows:

[*a*][b] = [min { $\underline{ab}$, $\underline{a}\overline{b}$, $\overline{a}\underline{b}$, $\overline{ab}$ }, max { $\underline{ab}$, $\underline{a}\overline{b}$, $\overline{a}\underline{b}$, $\overline{ab}$ }]

1) If $0 \leq \underline{a} \leq \overline{a}$ *and* $0 \leq \underline{b} \leq \overline{b}$ then write

$$[a][b] = \left[\underline{ab}, \overline{ab}\right]$$

2) If $0 \leq \underline{a} \leq \overline{a}$ *and* $\underline{b} < 0 < \overline{b}$ then write

$$[a][b] = \left[\underline{a}\overline{b}, \overline{ab}\right]$$

3) If $\underline{a} \leq \overline{a} \leq 0$ *and* $0 \leq \underline{b} \leq \overline{b}$ then write

$$[a][b] = \left[\overline{a}\underline{b}, \underline{a}\overline{b}\right]$$

4) If $\underline{a} \leq \overline{a} \leq 0$ *and* $\underline{b} < 0 < \overline{b}$ then write

$$[a][b] = \left[\overline{a}\underline{b}, \underline{ab}\right]$$

(vii) There are several approaches to define interval division. Consider the quotient of two intervals as follows: Let [*a*] = [ $\underline{a}$, $\overline{a}$ ] and also [b] = [$\underline{b}$, $\overline{b}$] be two nonempty bounded real intervals. Then if $0 \notin [\underline{b}, \overline{b}]$ write

$$[a]/[b] = [\underline{a}, \overline{a}]\left[\frac{1}{\overline{b}}, \frac{1}{\underline{b}}\right]$$

(viii) For an interval [a] such that $\underline{a} \geq 0$, define the square root of [*a*] denoted by $\sqrt{[a]}$ as: $\sqrt{[a]}$ = { $\sqrt{b} : \underline{a} \leq b \leq \overline{a}$ }.

| | | | | | |
|---|---|---|---|---|---|
| **$F_3$** | 9 | 11 | 5 | 7 | 18 |
| **Demand** | 12 | 4 | 15 | 17 | 48 |

Table-3:

Half –width TP(W) of the problem(P)

| | **$D_1$** | **$D_2$** | **$D_3$** | **$D_4$** | **Supply** |
|---|---|---|---|---|---|
| **$F_1$** | 0.5 | 1 | 2 | 3.5 | 1 |
| **$F_2$** | 0.5 | 1.5 | 2 | 1 | 2 |
| **$F_3$** | 1 | 1 | 1 | 1 | 1 |
| **Demand** | 1 | 1 | 1 | 1 | 4 |

The given problem modified as interval ITP as follows

An optimal solution to the problem(U) is $u_{11}^*=9$, $u_{21}^*=3$,$u_{24}^*=14$,$u_{33}^*=15$,$u_{34}^*=3$ and

An optimal solution to the problem(W) is $w_{11}^*=1$,$w_{12}^*=1$,$w_{21}^*=1$,$w_{23}^*=1$,$w_{24}^*=1$,$w_{33}^*=1$

Therefore, an optimal solution to the given transportation problem (P) is

$[x_{11},y_{11}]=[8,10]$,$[x_{21},y_{21}]=[3,3]$,$[x_{22},y_{22}]=[3,5]$,$[x_{24},y_{24}]=[13,15]$,$[x_{33},y_{33}]=[14,16]$,$[x_{34},y_{34}]=[3,3]$ with minimum interval transportation cost[128,252].

## 5. Conclusion

This paper focused on fixed charge TP when parameters are vague in the nature. In particular, all parameters are delivered in interval form. Different approaches which are considered while dealing with interval parameters have been investigated. A new method namely upper value method for computing an optimal solution to fully transportation problems has been proposed in this paper. A numerical example has been presented for demonstrating the solution procedure of the proposed method.

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PAPER

# Effect of morphology on the photocatalytic property of PANI/$TiO_2$ on some synthetic dyes

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**Keywords:** PANI, titanium dioxide, photocatalysis, cationic dyes, morphology, nanocomposite

## 1. Introduction

As a typical conducting polymer, polyaniline (PANI) is unique due to its high stability, low cost, high charge (electron-hole) carrying efficiency and ease of synthesis [1–3]. Since its discovery by Chiang and MacDiarmid, PANI has captured the highest attention of researchers [4]. In particular, nanostructured particles combined with organic PANI can give rise to a polymer nanocomposite with many interesting physical properties and are thus potential materials for newer materials for novel applications. $TiO_2$ is a typical n-type semiconductor whereas PANI being a p-type conducting polymer [5, 6] makes their combination an interesting conductive and stable composite [7]. In addition, the resultant nanocomposite can be synthesized in the form of nanofibers, nanorods and thin films etc.

Research in the development of PANI/$TiO_2$ nanocomposites started with the work of Liu and Guo [8] who studied the photocatalytic properties of $TiO_2$ nanoparticlesfor degradation of phenol under UV irradiation or sunlight. They showed better catalytic activity than pure $TiO_2$ nanoparticles. It was inferred that the surface state of $TiO_2$ is changed when it is in combination with PANI which led to the better photocatalytic activity of the nanocomposites in comparison to pure $TiO_2$ nanoparticles. Lateron, several other studies followed in investigating the synergetic effects of PANI and $TiO_2$in photodegradation of toxic organic compounds andwas foundto show better results. Wei *et al* [9] concluded that the strong forbidden band gap of 2.8 eV of PANI showing strong absorption in the region of visible light may function as sensitizer to $TiO_2$ which will enhance the photocatalytic activity of $TiO_2$. Similarly, Wang and Min [10] also explained the sensitization effect of PANI in degradation of methylene blue. Salem [11] studied the effect of various experimental factors in photocatalytic degradation of Allura red and Quinoline yellow with PANI/$TiO_2$ nanocomposites. Tang *et al* [12] found that the photocatalytic oxidation of aniline resulted in its degradation or polymerization depending upon its concentration.

With the illustration presented in figure 1, the role played by PANIas a photocatalyst can be understood. The greater photocatalytic activity of the composite can be attributed to the efficient separation of electron and hole pairs in the excited state where PANI and $TiO_2$ are coupled. When the composite is illuminated under UV light, both the $TiO_2$ and PANI absorb the photons and charge separation occurs. Since the d-orbital (conduction band) of $TiO_2$ and the $\pi^*$-orbital (LUMO level) of the PANI are well matched for the charge transfer, the electrons which are promoted from a $\pi-\pi^*$ absorption band of PANI upon light, are easily injected into the conduction band of $TiO_2$ nanoparticles. Whereas electrons in the valence band of $TiO_2$ are transferred into the PANI and leaving behind holes which can yield hydroxyl and superoxide radicals on the surface of $TiO_2$ leading to the higher activity.

In this work, the role of PANI in photocatalytic degradation of PANI/$TiO_2$ nanocomposite on various kinds of dyes was studied. While there have also been the efforts to synthesize PANI/$TiO_2$ composite nanofibers without any external template because in the case of template synthesis post-synthetic treatments are needed to remove them from the products to recover the nanostructured PANI composites. Therefore, it is important to

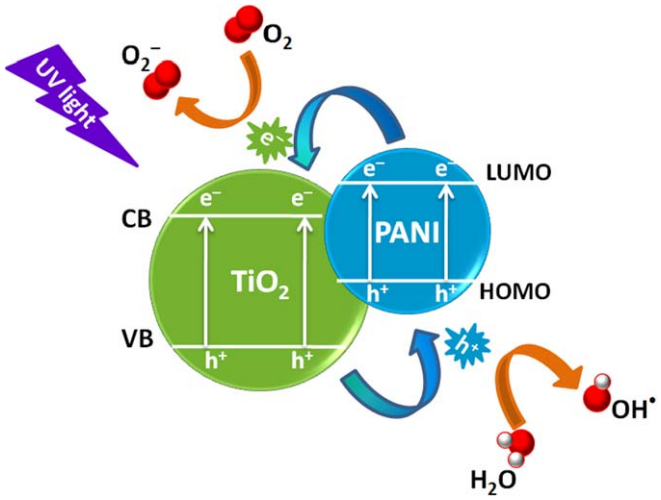


**Figure 1.** Schematic representation of photocatalytic mechanism in PANI/$TiO_2$ composite.

develop a synthesis that do not rely on templates, structural directing molecules, or specific dopants, especially forscaling up to produce large quantities of nanostructured composite materials. Previous researchers have shown that properties of PANI/$TiO_2$ composites are quite different from pure PANI or $TiO_2$, which is due to the existence of strong interaction between two components [13, 14]. The synthesis method has a great effect on the final properties ofPANI/$TiO_2$ composite [15–17]. *In-situ* polymerization of aniline in the presence of $TiO_2$ precursors and filtration of composite under gravity has been reported to have nanofibriller morphology and it has been used commonly for preparation of PANI/$TiO_2$ nanocomposites [15, 18, 19].

Employing a mixture of sodium hypochlorite (NaOCl) and Ammonium persulfate (APS), Rahy *et al* [20] synthesized PANI nanofibers of few micrometers in length, and 40 nm or less in diameter, showing high conductivity and a narrow molecular weight distribution. NaOCl is not only increasing the polymerization rate, it is promoting, possibly, the tail-to-tail coupling between the aniline radical cations during polymerization [21]. PANI nanofibers were prepared by using NaOCl and the effect of morphology of PANI on photocatalysis was also investigated.

## 2. Methodology

In the present work, titanium tetra-isopropoxide ($Ti(OPr^i)_4$, TTIP, assay ⩾97%) (Sigma-Aldrich), isopropyl alcohol (Propan-2-OL, $(CH3)_2$·CHOH, assay > 99%) (Merck) were the chemicals used for synthesis of $TiO_2$nano-particles. For synthesizing PANI, hydrochloric acid (HCl, 37%) (Merck), aniline ($C_6H_7N$) (⩾99%) (Alfa aesar), ammonium persulfate ($(NH_4)_2S_2O_8$) (assay ⩾ 98%) (Sigma-Aldrich) and sodium hypochlorite (NaOCl) (11%–15% available chlorine) (Alfa aesar) were used. For the photocatalysis experiment, Methylene blue ($C_{16}H_{18}N_3SCl$) (assay >82%) (Nice), Eosin yellowish ($C_{20}H_6Br_4Na_2O_5$) (Alfa aesar), Rose bengal ($C_{20}H_2Cl_4I_4Na_2O_5$) (95%) (Sigma-Aldrich) and Malachite green ($C_{23}H_{25}ClN_2$) (LobaChemie) were the dyes used.

### 2.1. Synthesis of $TiO_2$ nano-particle

Titania nano-particles were prepared by modifying the simple sol-gel technique reported by Praveen *et al* [22]. Briefly, 10 ml of titanium tetra-isopropoxide was dissolved in 90 ml of isopropyl alcohol and 5 ml of deionized water was slowly added to the solutionwith vigorous stirring. The stirring was continued for 3 h at room temperature using a magnetic stirrer. The solution transforms into white gel and the obtained gel was filtered and washed several times with ethanol and deionized water. The yield was dried at 100 °C for 3 h and left overnight. Then the powder was ground well in a mortar. Finally the powder was calcined at 500 °C for 5 h in muffle furnace to improve it's crystal structure.

### 2.2. Synthesis of PANI and PANI fiber

In a typical synthesis method, 0.3 ml aniline was added to 190 ml 1 M HCl (referred as solution A) and 0.863 g APS was added to 15 ml 1 M HCl (referred as solution B). Again these two solutions were mixed for 5 h using magnetic stirrer. Then the mixture was filtered, washed with 1 M HCl, deionized water and acetone respectively. Finally the resultant powder was dried at 80 °C overnight. To prepare the nanofiber, 3.8 ml aniline was added to

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# செம்மொழித் தமிழ்

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6 பகுதி-4
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# தொகை அக அடைநூல்களில் வல்லின ஓரெழுத்தொரு மொழி

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உதவிப்பேராசிரியர் & நெறியாளர், அன்னை ஹாஜிரா பெண்கள்கல்லூரி,
மேலப்பாளையம், தமிழ்நாடு, இந்தியா.

சங்க இலக்கியங்களுள் தொகை நூல்கள் என அழைக்கப் பெறுவது எட்டுத் தொகை நூல்கள் ஆகும். இவற்றுள் அகநூல்கள் ஐந்து. அவற்றுள் அடைமொழியுடன் அமைந்தநூல்கள் மூன்று உள்ளன. அவை நற்றிணை, குறந்தொகை, ஐங்குறுநூறு ஆகும். அவற்றிலமைந்துள்ள வல்லின ஓரெழுத்தொருமொழியைக் கண்டறிந்து வகைப்படுத்தி மெய்ம்மைகளைக் கண்டறிந்து இக்கட்டுரை விளக்குகிறது.

**வல்லின ஓரெழுத்து ஒருமொழி**

தொகை அகஅடைநூல்களில் **கை, கோ, சா, தீ, தூ, பா, பூ, பை** என்ற வல்லின ஓரெழுத்து ஒருமொழி புலவர்களால் எடுத்தாளப்பட்டுள்ளது.

**கை – கரம்**

கை என்பது விலங்கு மற்றும் மனிதனின் உடல் உறுப்பைக் (கரம்) குறிக்கும் வகையில் தொகை அகஅடை நூல்களில் அமைந்துள்ளது.

சான்றாக

**அசுணம் கொல்பவர் கை போல் நன்றும்**
**(மாறோக்கத்து நப்பசலையார்: குறிஞ்சி: நற்.304 : 10)**

என்பதனைச் சுட்டலாம்.

இதே பொருளில் இதே சொல்லில் குறுந்தொகை **8, 58 , 61, 117, 199, 342** ஆகிய பாடல்களில் பயன்படுத்தப்பட்டுள்ளது. சான்றாக

**கையில் ஊமன் கண்ணின் காக்கும்**
**(வெள்ளிவீதியார் : குறு : 58 : 4)**

என்ற வரிளைச் கூறலாம்.

**கை - துதிக்கை**

துதிக்கை என்னும் பொருளில் குறந் தொகை 141, ஐங்குறுநூறு 37, 255, 319 ஆகிய பாடல்களில் கை என்னும் வல்லின ஓரெழுத்து ஒருமொழ துதிக்கை என்ற பொருளில் பயன்படுத்தப்பட்டுள்ளது.

அவை

**குறுங்கை இரும்புலிக் கொலைவல் ஏற்றை**
**(மதுரைப் பெருங்கொல்லன: : குறிஞ்சி : குறு. 141 : 5)**

**அஞ்சாயோ இவள் தந்தை கை வேலே**
**(ஓரம்போகியார் : மருதம் : ஐங்.: 60 : 4)**

**கடற்கோடு செறிந்த மயிர் வார் முன்கை**
**(அம்மூவனார் : நெய்தல் : ஐங்.: 191 : 1)**

**பெருங்கை யானை இருஞ்ஞ் சினம் உறைக்கும்**
**(ஓதலாந்தையார் : பாலை :ஐங்.: 352 : 3)**

ஆகும்.

**கை - சாமர்த்தியம்**

கை என்ற ஓரெழுத்தொரு மொழி சாமர்த்தியம் என்னும் பொருளில் ஆளப்பட்டுள்ளது.

**கை வல் சீறி யாழ்ப் பாண! நுமரே**
**(பேயனார் : முல்லை :ஐங். : 472: 1)**

**சா - இறத்தல்**

சா என்ற ஓரெழுத்தொரு மொழி இறத்தல் என்னும் பொருளில் பாடலில் ஆளப்பட்டுள்ளது. சான்றாக நண்டு பிறந்த உடனேயே அதன் தாயைச் சாகடித்து விடும் என்ற பொருளில் அமைந்த

# A STUDY ON WORK DOMAIN FACTORS AFFECTING WORK-LIFE BALANCE AMONG WOMEN EMPLOYEES OF GOVERNMENT HOSPITAL IN TIRUNELVELI CITY

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## Abstract

The role of working women has changed throughout the world due to economic conditions and social demands. Work-Life-Balance means "Work-Family-Balance". Having work-life balance is getting to do everything you want to do on a given day, week or month. Hence it is very necessary to know how women can balance their professional and domestic life. This has resulted in a scenario in which working women have tremendous pressure to develop a career as tough as their male counterparts while sustaining active engagement in personal life. The ever-increasing work pressure is taking a levy on the working women leaving them with less time for themselves. The increasing responsibilities on the personal front with technological blessings like advanced mobile phones, notepads, etc. that keep work-life integrated with personal life also creates stress on personal and professional fronts in this knowledge age. This affects the person's physical, emotional and social well-being. Thus, achieving work-life balance is a necessity for working women to have a good quality of life. This paper is an attempt to explore the tough challenges faced by working women in maintaining a balance between their personal and professional life. The various work domain factors affecting the work-life balance of married working women of the government hospital in Trinelveli have been examined in this study. Data were subjected to descriptive statistics and it was found that the problems faced by the working women in terms of work-life balance are quite high. The results also indicate that the work-life balance of individuals affect their quality of life.

***Keywords: Work-life balance, work domain factors, challenges, Work-Life Imbalance, professional with personal***

## INTRODUCTION

In this competitive world, every organization needs to create a congenial atmosphere that can help the employees to balance their personal and

professional roles. But due to increased working hours, the individuals are left with less time for themselves. As a result, the personal and spiritual growth of an individual is also hindered.

Due to intense competition in the world business, the presence of working women has become increasingly visible. And the increased economic conditions have necessitated both husband and wife to do a job for having a normal life. Though a woman has achieved tremendous success in her career but still her responsibility towards home has not decreased. She has to manage her household chores, look after her kids and so on. For women, both personal and office roles are demanding. As a result, such pressure affects her health thereby leading to absenteeism from organisation. Hence it becomes essential to help working women to maintain a balance between their personal and professional lives. At home, she has to deal with the demands of her kids, husband, and in-laws whereas in office she has to bear the brunt of office demands.

Due to high work pressure in private sector jobs, it has also become difficult for women to maintain a healthy family life. Hence, it is assumed that work-life balance can help in bringing a huge transformation in an individual's life. This will further help the individuals in realising their dreams also. For implementing work-life balance practices, employers need to understand its importance. For supporting work-life balance, the employers may have to incur additional costs in implementing such policies. Work-life balance helps in describing a balance between person and working life. The term work-life balance is given preference as it includes the experiences of working mothers and helps in exploring new ways of working and living for them. Managing a balance between family and work life is the biggest challenge for both working people and the organization. Particularly for nurses and lady doctors, it has become more difficult to strike a balance between the two. They will be able to give their best only when clinics and hospitals have work-life balance policies for them. Work-life balance policies and programs will help them in balancing their personal and professional schedules. This will ultimately give them a feeling of satisfaction.

The key areas that are affected by work-life balance are namely retention of employees, an increase in motivation and employee productivity, a decrease in healthcare costs, reduced absenteeism and stress-related illness, etc. For

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*Our Heritage*

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# Current Scenario of Unorganised Sector With Special Reference To Rural Entreprenuers In Tirunelveli District

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## ABSTRACT

As an unorganised worker play a pivotal role in society, so they need special attention. Most socially and economically deprived sections of the society are engaged in informal economic activities. The government realised the pivotal role performed by unorganised sector in the economy. Therefore, many legislations and schemes are initiated by the government for the benefit of unorganised workers. Based on the distinctiveness, the government has classified the unorganised workforce exclusively in the following categories.
In terms of employment like construction workers, waiver, fisheries, workers of the paper mill, sawmill etc. The labourers which are most in exploited-Head and shoulder loaders, scavengers, variety of labour works. Labourers who are providing service-Hotel boy, Midwives, Air Hostesses, barber, masseur etc.

Apart from category described above handicrafts, artisans, cobblers, handloom weavers, physically handicapped self-employed persons, lady tailors, a rickshaw puller, carpenters, tannery labour, power loom workers and urban poor, Truck and Auto drivers also come under the ambit of unorganised labour.

The term rural entrepreneurs mean the persons who are involved in the activities of the entrepreneurial events in the rural areas. The entrepreneurial activities are the most important activity which helps for the development of the rural areas and also helps in strengthen the economic condition of the country. Entrepreneurship also reduces the unemployment problem and also reduces the migration of the rural people to urban and to semi urban area. It also helps in promoting the agriculture product and also develops the industrialization activities. There are many government programs and schemes to help the entrepreneurial activities and also lot of EDP (Entrepreneurial Development Programs) are supporting and creating awareness about the entrepreneurship still the rural entrepreneurs are facing many problems like getting funds from the financial institutions, technological strains and also they are facing the market strains also for distributing their products. Government also implement GST taxation and demonetization also create some impacts in their business. So the study reveals about the current challenges faced by the rural entrepreneurs.

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**Keywords**: challenges, problems, entrepreneurship, unorganized sector, opportunities.

## 1. INTRODUCTION

### UNORGANISED SECTOR

The sector which is not registered with the government and whose terms of employment are not fixed and regular is considered as unorganised sector. In this sector, no government rules and regulations are followed. Entry to such sector is quite easy as it does not require any affiliation or registration. The government does not regulate the unorganised sector, and hence taxes are not levied. This sector includes those small size enterprises, workshops where there are low skill and unproductive employment.

### ENTREPRENEURSHIP

The concept of entrepreneurship has a wide range of meanings. On the one extreme an entrepreneur is a person of very high aptitude who pioneers change, on the other extreme of definitions, anyone who wants to work for himself or herself is consider being an entrepreneur.

The word entrepreneur originates from the French word, entreprendre, which means “to undertake”. In a business context, it means to start a business. The Merriam – Webster dictionary presents the definition of an entrepreneur as one who organizes, manages, and assumes the risks of a business or enterprise.

### MEANING OF RURAL ENTREPRENEURSHIP

Rural entrepreneurship means creating or establishing the large and small scale units in the rural areas or shifting of plants or units away from the urban area for developing the living standard of rural people. In other words, the industries which are established in the rural areas which can produce the best type of products where skilled labor of specific nature is required.

### NEED FOR RURAL ENTREPRENEURSHIP

The following are the needs for rural entrepreneurship

### EMPLOYMENT OPPORTUNITIES

If the industries are established in rural areas means it will automatically generate the employment opportunities in the rural sector as they are labor intensive.

### AVOID MIGRATION

 

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# A Fuzzy Model for the Optimization of Cross Flow Cooling Tower using Mamdani Rule Modelling

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**Abstract-***Nowadays in a medium scale industry, optimization of working cross flow of a cooling tower in a captive power plant is more challengeable. In the cooling tower optimization process is done in terms of high effectiveness and outlet water temperature, which has been brought out using mamdani type fuzzy rule modelling. Optimization is done by analyzing certain input parameters such as relative humidity, dry bulb temperature, inlet water temperature and liquid to gas ratio and is carried out with the help of MATLAB fuzzy logic toolbox. In the present situation it is very difficult to conduct experiments for the industrial cooling tower. Therefore, a Fuzzy model is developed. The model is made with specified dimensions and the readings were taken for various time intervals. The reliability of the fuzzy model was checked and the error percentage is within 6%. The predicted results are found to be in concurrence with the experimental results which confirm reliability of the proposed fuzzy model.*

***Keywords*** **-** Cross flow-cooling Tower, Outlet water temperature, Flow rate and Fuzzy model.

## 1. INTRODUCTION

The design of power plant includes various subsection among them the most important section is cooling tower. At low temperature cooling tower is responsible for extracting waste heat into the air through the cooling of water stream. Though it has many applications, cooling tower used for electric power generation is the major one.

G.Ganand S.B.Riffat [21] evaluated the performance of a closed wet cooling tower for chilled ceiling systems. It was found that for prediction and optimization of thermal performance, operation and design of the cooling tower CFD (Computational fluid dynamics) is most appropriate tool for chilled ceiling. Nenad and Pertti [20] derived a mathematical model based on one dimensional heat and mass balance equations for a counter flow wet cooling tower with the help of measured heat transfer coefficients. Prasad [19] proposed a method for economic up gradation of a cooling tower by replacement of fill, starting with the worst affected then replacing in sequential manner. Tower performance will be decreased, while increase in L/G Ratio was showed by Farhad Gharagheizi et al. [14]. M. Hosozet al. [15] revealed that for modeling the cooling tower ANN is an alternate method. ANN Reliability is proved in terms of Mean Relative Error. The cooling range will be more for lower liquid to gas ratio values.

M. Lemouari, M. Boumaza and I.M. Mujtaba, [16] in their research it is found that the best water cooling is obtained because of higher inlet water temperature and low water flow rate. E. Hajidavalloo et al. [12] found that increase in inlet air wet bulb temperature increases the outlet water temperature. Similarly, increase in dry bulb temperature at constant wet bulb temperature, increases the evaporation rate. M. Serna-González et al. [11] revealed that for an optimal design of cooling towers factors like L/G Ratio, Inlet water temperature, Wet bulb temperature, Water outlet temperature, Water loss by evaporation must be considered simultaneously.

E. Rubio-castro et al. Cabrera [10] presented an optimal design algorithm for counter flow wet cooling towers based upon rigorous poppe model and mixed – integrated nonlinear programming (MNLP). R.Ramkumar and A.Ragupathy [8] discussed the application of Taguchi method in assessing maximum cooling tower effectiveness for the counter flow cooling tower which is done using expanded wire mesh packing.

M. Khamis et al. [5] developed an innovative correlation for effectiveness-NTU of counter flow cooling tower. Arash et al. [6] developed a rotational splash type packing cooling tower. In this paper, he revealed that when the rotational splash type packing rotates at higher velocity more heat rejection takes place from water. Thirapong et al. [17] in his research the performance of the water jet

cooling tower using experimental and numerical simulation is analyzed and tabulated. Energy and second law efficiency is affected by reasonable variation in droplet diameter, tower spray zone height, L/G ratio.N. Tao et al. [7] reported that increase of L/G ratio will decrease the tower characteristic.

Ritwick et al. [4] found that cooling tower evaporation loss account for one of the foremost sources of industrial water loss and explores the possibility of fog capture from cooling tower plume. Pooriyasahalai et al. [3] proposed some standards to attain optimum operating conditions of wet cooling tower. Elazm et al. [13] studied a cross flow induced draft cooling tower theoretical and experimentally and found a correlation in order to achieve efficiency in wet bulb operation. For this study, a cross flow cooling tower which is positioned in a captive power plant in a medium scale industry is selected. Immanual et al. [2] developed a new software that will help to predict the Thermal Performance of a cross flow-cooling tower which is situated in a medium scale industry in various districts across India. Rafat and Behnia [18] predicted the thermal performance of the natural draft wet cooling tower which can be enhanced, when the cross wind velocity is higher than 7.5 m/s.

Fuzzy logic [22, 24] is one of artificial intelligence models that involves phonological variables and experimental associations to match with the human reasoning and intuition. Fuzzy is well-known for its ability to solve complex problems with several conditions. It is a suitable tool for combining reckonable factors with qualitative interactive concepts. Fuzzy logic is a superset that works between completely false and true values. The controlling stages of any fuzzy systems involve fuzzification, decision making and de-fuzzification.

Tarik A. Rashidand Haval et.al, have performed modelling and planning a student management system based on gross point average using fuzzy concepts and the accuracy of results were appreciable [9]. T. Takagi et.al [23] found that the fuzzy models have superior qualities than the numerical models since the interpretation was nearer to human thinking and also its ease of viability to work with nonlinear systems. The present inputs (inlet water temperature, dry bulb temperature, relative humidity, liquid to gas ratio) from the site were used to check the reliability of the fuzzy model. The parameters are optimized using mamdani type fuzzy rule modelling. Alagumalai Malairajan et al. [1] proposed a mathematical model for the optimization of the cross flow-cooling tower using taguchi-grey analysis.

## 2. PROPOSED WORK

### 2.1 Mamdani-Type Fuzzy Rule Modelling

Zadeh has acquaint with fuzzy logic to build a numerical framework for the data that were presented vaguely, which was a common form of interval analysis with high and low values. In set theory, the variable is considered to be a part of a set. The rank of the variable is assumed to be one if it lies inside set otherwise it is taken as zero. Fuzzy is a non-conventional set theory wherein the elements have a certain degree of membership function. The output values of fuzzy set gives the correlation between the indeterminate data and the membership function whose value ranges from 0 to 1. The fuzzy implications illuminate a multifaceted fuzzy system. The above stated implications along with the experimental data can be developed as a mamdani model. The system planning can be done by mamdani models which use more number of rules. The input matrix (X) and the output vector (g) of a fuzzy system are defined as follows:

$X = [x1 , x2 ,\ldots\ldots, xn ]\ T$ & $g = [g1 , g2 ,\ldots\ldots, gn ]$

The propositions of the fuzzy mamdani system include both the antecedent and consequent. A common form of if-then rule of fuzzy is given by, Ri: if x is Ai then y is Bi, I = 1, 2,....., k.

In the above expression, the rule number is expressed by Ri, the sets are represented by Ai& Bi, and both the antecedent and consequent variables are represented by x, y. Fuzzy set of input and output variables are represented in table 1.

**Table - 1:** Fuzzy set of input and output variables

| | L/G | DRYT | RH | IWT | OWT |
|---|---|---|---|---|---|
| 1 | 0.8 | 30 | 45 | 46 | 24.83 |
| 2 | 0.8 | 32 | 55 | 48 | 27.17 |
| 3 | 0.8 | 34 | 65 | 50 | 29.75 |
| 4 | 0.8 | 36 | 75 | 52 | 32.59 |
| 5 | 1 | 34 | 45 | 48 | 28.64 |
| 6 | 1 | 36 | 55 | 46 | 30.79 |
| 7 | 1 | 30 | 65 | 52 | 29.11 |
| 8 | 1 | 32 | 75 | 50 | 31.15 |
| 9 | 1.25 | 36 | 45 | 50 | 31.61 |
| 10 | 1.25 | 34 | 55 | 52 | 32.06 |
| 11 | 1.25 | 32 | 65 | 46 | 31.42 |
| 12 | 1.25 | 30 | 75 | 48 | 31.62 |
| 13 | 1.5 | 32 | 45 | 52 | 32.15 |
| 14 | 1.5 | 30 | 55 | 50 | 31.94 |
| 15 | 1.5 | 36 | 65 | 48 | 34.86 |
| 16 | 1.5 | 34 | 75 | 46 | 34.5 |

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# A MODERN APPROACH FOR SOLVING INTERVAL BASED ASSIGNMENT PROBLEM

M. RADHA [1], DR. S. ANANTHALAKSHMI, AND DR. R. USHA PARAMESWARI

ABSTRACT. The assignment problem (AP) is a special case of the transportation problem, in which the objective is to assign a number of resources to the equal number of activities at a minimum cost (or maximum profit). We endeavour in this paper to introduce a modern approach to assignment problem based on intervals for solving wide range of problem. Considering the recent complexity, it is not enough to make should be a perfect assignment plan only based on. In this paper, the aim is to evaluate a assignment problem under uncertainty (in interval form) and also convert interval assignment problem into its mathematical form. At the end, a numerical example is given to show the optimal solution of the model.

## 1. INTRODUCTION

"The best person for the job" is an apt description of the assignment model. An important topic, put forward immediately after the transportation problem, is the assignment problem.

The assignment models is a special state of a linear programming models and its similar to the transportation model. Assignment models deals with the topic how to assign n workers to n jobs such that the cost incurred is minimized. It was developed and published in 1955 by H. Kuhn, who gave the name "Hungarian method" because the method in general based on the

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*Key words and phrases.* Assignment problem, Interval, Uncertainty, Optimal solution.

earlier works of two Hungarian mathematicians: D. Konig and J. Egervary and is therefore known as Hungarian method of assignment models [2]. In most cases that parameters of the problem are not available in precise values, they are expressed in interval. While dealing with assignment problem, the most important tool namely range convert the interval into their equivalent cost entries. The situation can be illustrated by the assignment of workers with varying degrees of skill to jobs [4]. Saragam Majumdar [6] was introduced an interval linear assignment problems. G.Ramesh and Ganesan and Deepa [3, 5] have proposed a new computational technique to solve assignment problem with generalized interval Hungarian method. Amutha et al. [1] has studied a method of solved extension of the interval in assignment problem.

## 2. Interval Arithmetic

The interval form of the parameters may be written as where is the left value $[\underline{x}]$ and is the right value $[\bar{x}]$ of the interval respectively.

Let $[\underline{x}, \bar{x}]$ and $[\underline{y}, \bar{y}]$ be two elements then the following arithmetic are well known

(i) $[\underline{x}, \bar{x}] + [\underline{y}, \bar{y}] = [\underline{x} + \underline{y}, \bar{x} + \bar{y}]$

(ii)$[\underline{x}, \bar{x}] - [\underline{y}, \bar{y}] = [\underline{x} - \underline{y}, \bar{x} - \bar{y}]$

(iii) $[\underline{x}, \bar{x}] \times [\underline{y}, \bar{y}] = [min\{\underline{x}\underline{y}, \underline{x}\bar{y}, \bar{x}\underline{y}, \bar{x}\bar{y}\}, max\{\underline{x}\underline{y}, \underline{x}\bar{y}, \bar{x}\underline{y}, \bar{x}\bar{y}\}]$

## 3. Interval assignment problem

Consider a problem of assignment of n resources to $m$ activities so as to minimize the overall cost or time in such a way that each resource can associate with one and only one job based on interval. The cost matrix

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# AN INNOVATIVE METHOD TO SOLVE TRANSPORTATION PROBLEM BASED ON A STATISTICAL TOOL

G. PADMA KARTHIYAYINI[1], S. ANANTHALAKSHMI, AND R. USHA PARAMESWARI

ABSTRACT. Transportation Problem is one of the models in the linear programming problems. In this paper, we have developed a new method for finding of the initial basic feasible solution of the transportation problem. The objective of this paper is to find how to transport the product from the origin to the destination such that the transportation cost will be minimized. To achieve this new approach, the transportation problem under uncertainty, is considered by using of the arithmetic mean.

## 1. INTRODUCTION

In the linear programming problems, Transportation Problem (TP) plays an important role. Nowadays, the business environment competition is raising a day by day and it is most important for every goods to deliver products to customers in the cost effective way by satisfying their demandsfor dealing with human uncertainty, [3]. Uncertainty theory was founded by Liu (2007) and refined by Liu (2010) based on normality, duality, sub additivity and product axioms. TP was developed by Hitchcock, [4] concerning its special structure for finding initial basic feasible solution such as, North west corner method (NWCM), Least cost method, vogel's approximation method given by Reinfeld et al. in [9]. There are two types of TPs, first type is balanced TP and the second

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type is unbalanced TP. In the first type, the number of supply is equal to the number of demand, and if it is not equal means unbalanced. To find optimal solutions to TP different methods are discussed in many papers [2, 10] and so far. Abdul Kalam Azadet et al. in [1] gave an algorithmic approach to solve TP with the average total opportunity cost method. Joshua et al. in [6] developed a NWCM to give an initial basic feasible solution for TP. Juman and Nowarathne in [5] give an efficient alternative approach to solve a TP. Palanivel and Suganya in [7] developed a new method to solve transportation problem for harmonic mean approach and Patal et al. in [8] to find a optimal solution of TP.

In this paper we discuss about to study a transportation model with uncertain values (unit cost, demand and supplies). Then, it will be converted into single values and solved it.

## 2. Uncertain Transportation Model

Assume that there are $m$ sources and $n$ destinations in the transportation problem. Let $C_{ij}$ denote the cost of transporting a unit from source $i$ to destination $j$, and $x_{ij}$ denote the amount transported from source $i$ to destination $j,\ i = 1, 2, ..., n$. Then the total cost as well as the objective function is

$$\sum_{i=1}^{m}\sum_{j=1}^{n} C_{ij}x_{ij}.$$

Subject to

$$\begin{aligned}\sum_{j=1}^{n} x_{ij} &= a_i, \quad i = 1, 2, ..., m\\ \sum_{i=1}^{m} x_{ij} &= b_j, \quad j = 1, 2, ..., n.\end{aligned}$$

Let $a_i$ denote the availability of source $i$, and $b_j$ denote the requirement of destination $j$. Then the amount $x_{ij}$ should satisfy the following constraints,

$$\begin{aligned}\sum_{j=1}^{n} x_{ij} &\leq a_i, \quad i = 1, 2, ..., m\\ \sum_{i=1}^{m} x_{ij} &\geq b_j, \quad j = 1, 2, ..., n.\end{aligned}$$

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# A STUDY ON ENTREPERNEURIAL ATTITUDE AMONG COMMERCE STUDENTS OF ARTS AND SCIENCE COLLEGES IN TIRUNELVELI DISTRICT

Dr . T.Stanley Davis Mani*

Mrs.P.Parvathy**

*Abstract*

*Entrepreneurship has become an everyday buzzword. Policymakers, Economists, academics and even students are talking about it. Seminars, Conferences and Workshops are being organised every year access the world which emphasised on the importance of entrepreneurship to country, society as well as individual development. Today entrepreneurship is regarded as area of the best economic growth and sustain the country's competitiveness is facing the increasing trends of globalisation. Entrepreneurship is largely due to the positive effects it has an many countries as a catalyst that creates wealth and generation of job opportunities. Courses in entrepreneurship are also becoming a popular at college and university levels an exponential interest in entrepreneurship studies has increased among students over the last decade. In today's competitive job environment total job opportunities are inevitably limited and there are must compete to secure a job as supply of jobs is limited. As a result, many graduates are unable to get a job after graduation so we have to become self-sustainable. This self sustainability can be possible through entrepreneurship. This present study is an attempt to evaluate the entrepreneurial attitude among commerce students of arts and science collages in Tirunelveli District. The study was conducted among 220 students who are pursuing their UG commerce degree in various arts & science colleges in Tirunelveli district. The study will help university programme instructor in designing and enhancing entrepreneurship course structure, subjects offering as to proactive and practical oriented with the aim of sustaining student's interest in entrepreneurship.*

*Keywords: Entrepreneurship, Entrepreneurial attitude, career*

## INTRODUCTION

Since the last decade of twentieth century India has strived for an experienced and unprecedented economic turn-around. The country has witnessed a structural shift in GDP Growth, propelled largely by new investments and the growth of the value enhancing services sector. Now, the Indian Economy is the fourth largest economy in the world and is going to be a dominant force in the new world order in the coming years.

With the rest of the world looking up at India and China mainly because of low-cost manufacturing in services, countless business opportunities have opened up in this respect in both the countries.

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# A STUDY ON IMPACT OF E-BANKING SERVICES

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**ABSTRACT:**

Banking plays a vital role in Indian Economy. Nowadays banks simplify the public activity and highly technical advancements. Electronic bill payments , P2P payments , mobile payments, Electronic funds transfer at point of sale (EFTPOS) are introduced in banking industry. Internet banking is changing the banking industry to the extent level, having the major effects on banking relationships. Banking is now no longer confined to the branches were one has to approach the branch in person, to withdraw cash or deposit a cheque or request a statement of accounts. In true internet banking any inquiry or transaction is processed online without any reference to the branch at any time. The research paper will introduce to E-Banking, meaning, functions, types, advantages, limitations of E-Banking.

Keywords: E-Banking, Internet banking, Quality, ATM.

## INTRODUCTION:

E-Banking means any user with a personal computer and a browser can get connected to his banks website to perform any of the virtual banking functions. In internet banking system the bank has a centralised database that is web-enabled. All the services that the bank has permitted on the internet are displayed. E-Banking provides benefits to consumers in terms of easy and cost of transactions, either through internet, telephone or other electronic delivery.

## MEANING:

E-Banking is changing the banking industry, having the major effects on banking relationships. The following banks are sort out on the basis of successful electronic banking transactions.

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**OBJECTIVES OF THE STUDY:**

- To examine the importance, functions, advantages and limitations of E-Banking services.
- To study on impact of E-Banking services.

**Types of E banking services:**

- Electronic bill payments
- P2P payments
- Mobile payments
- EFTPOS

**FUNCTIONS OF E-BANKING:**

- **The Transaction of foreign exchange:**

  The client can trade the foreign exchange, cancel orders and inquiry about the information of the transaction of foreign exchange according to the exchange rate given by our bank on net.

- **Card Accounts Transfer:**

  They can achieve the fund to another persons credit card in same city.

- **Inquiry about the information of accounts:**

  The client inquires about the details of his own account information such as the cards or accounts balance and the records.

**TYPES OF E-BANKING:**

- Internet banking
- ATM
- Tele banking
- Smart card

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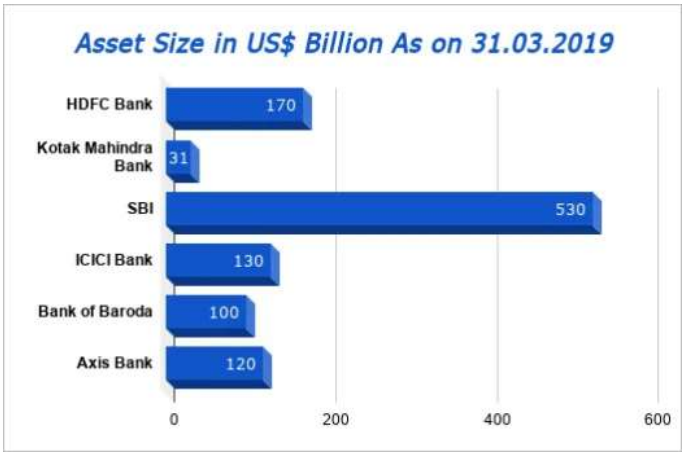
In paperless banking transactions, many problems of security are involved. A security threat is defined as a circumstances decision or event with potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of services , fraud, waste and abuse.




**CONCLUSION:**

Thus we concluded that a financial system play a vertical role in the economic growth of a country. It intermediates between the flow of funds belonging to those who save a part of their income and those who invest in assets. India financial system is quite huge and caters every kind of demand for funds.

*Studies in Indian Place Names*
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# Overview: Deep learning for Vehicle Detection Region –based Deep CNN on Object Detector

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***Abstract - Deep structured learning based techniques, have recently achieved tremendous success in digital image processing for object detection, classification and recognition, which includes vehicle detection method based on deep convolutional neural network (CNN) has become speed and accuracy level used by deep Learning based algorithms such as RCNN, Fast RCNN, Faster CNN, Grid RCNN, Cascaded RCNN, R-FCN and Mask RCNN etc. In field of the current the challenging tasks in this area of research to detecting vehicles on the road in real time is one of the most important problems in day to day life. Detection of vehicles to tackle many challenges such as occlusion of vehicles shadows of structures and etc., similarity in designs of vehicle leading to classification issues. To improves speed by using optimization algorithm based on SGD-Momentum. Datasets play a very important role in research vehicle detection used by datasets such as Pascal VOC 2007 and Pascal VOC 2012, COCO (2014), KITTI Vision (2014),ImageNet (2015), and Center for Biological & Computational Learning (CBCL).Evaluation metrics are performed well by using in vehicle detection methods such as mAp, AP, precision and recall.***

***Index Terms:*** ***Faster RCNN, R-FCN, some object detection, ImageNet, KITTI.***

## I. INTRODUCTION

Computer vision has successfully implemented the processing of images such as medical image, industry image, vehicle image, etc., object detection method based on convolutional neural network (CNN) has become the mainstream algorithm in field of the current object detection., the two-stage detection idea, in the positioning stage, we propose an improved loss function based on intersection over Union (IoU) for bounding box regression. Object detection, i.e. the problem of finding the locations of objects and determining their categories, is an intrinsically more challenging problem than classification since it includes the problem of object localization.

Object detection uses a pre-processing step to find a candidate set of bounding-boxes that are likely to encompass the objects in the image, vehicle detection are large variation of light, dense occlusion, and large variation of object scales.

State-of-the-art object detectors are based on a two-stage, proposal-driven mechanism. the detector finds the repeatable interest points, and the descriptor is a distinctive specification that is obtained by computing each detected feature which can be matched between different images. Girshick et al. proposed a popularized in the RPN[12] and R-CNN framework [6,7],is used to propose candidate regions is called to as the bounding-box proposal stage, Region Proposal Network takes raw image data as input and produces region of interest, which denotes the possibility of object existence, is used as Fast R-CNN. Grid -CNN starts with a multi-scale grid of fixed bounding boxes. Multibox [18] introduced a proposal algorithm that outputs 800 bounding boxes using a CNN. Multibox increases the size of the final layer of the CNN to 4096x800x5 and introduces a large set of additional parameters. Deformable Part-based Models [3]employed an idea similar to Implicit Shape Models, but proposed a direct optimization via latent variable models and used dynamic programming for fast inference, to fine-tuning the weights of fully connected layers. RPN [12] takes convolutional feature maps as input, and outputs potential RoI. The large variation of vehicle Scales causes RPN to ignore small objects. Focal Loss focuses training on a sparse set of hard examples and prevents the vast number of easy negatives from overwhelming the detector during training. To evaluate the effectiveness of the loss, design and train a simple dense detector used RetinaNet[25], trained with the focal loss; RetinaNet is able to match the speed of previous one-stage detectors while surpassing the accuracy of all existing state-of-the-art two-stage detectors.

The rest of paper is organized as follows. The following section II presents related work. Section III shows a conception of the method which describes the different methods used in vehicle detection and track vehicles. Section IV describes the results achieved and their comparison with some existing methods. Finally, section V is dedicated to draw a general conclusion.

## II. RELATED WORK

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Object detection is a major task in computer vision, and it can utilize the power of deep convolutional neural networks such as alexnet[8],vgg [11] and Resnet[12]. Vehicle detection detecting a vehicle entails both stating that an object belonging to a specified class is present and localizing it in the vehicle image and location of a vehicle is typically represented by a bounding box.

Viola and M. Jones et al.[1] a visual object detection framework that is capable of processing images extremely rapidly while achieving high detection rates. The integral image, by eliminating the need to compute a multi-scale image pyramid, reduces the initial image processing required for object detection significantly.

Navneet Dalal and Bill Triggs et al. [2], HOG descriptors significantly outperform existing feature sets for human detection. HOG-based detectors that incorporate motion information using block matching or optical flow fields. Finally, although the current fixed-template-style detector has proven difficult to beat for fully visible pedestrians, humans are highly articulated and we believe that including part based model with a greater degree of local spatial invariance.

Felzenszwalb et al. [3] based on mixtures of multi scale deformable part model, such as pictorial structures provide an elegant framework for object detection, significant variations in appearance, a single deformable model is often not expressive enough to represent a rich object category, to define a score at different positions and scales in an image, using a feature pyramid, which specifies a feature map for a finite number of scales in a fixed range. HOG features from different resolutions of a large number of images and performed PCA on these vectors. Alex Krizhevsky et al.[8],To make training faster, we used non-saturating neurons and a very efficient GPU implementation of the convolution operation. To reduce overfitting in the fully-connected layers we employed a recently-developed regularization method called “dropout” that proved to be very effective.

R. Girshick et al.[9] Regions in an image can be identified by varying colors, varying scales, varying textures and varying enclosures, A single deep ConvNet speeds us the image processing significantly unlike R-CNN that uses 2000 ConvNets for each region of the image. CNN runs the sliding windows over the entire image however R-CNN instead select just a few windows. R-CNN uses 2000 regions for an image. Fast R-CNN [15] is a fully convolutional network which at the same time predicts object bounds and object scores at each position. He et al. was proposed by Faster R-CNN [16] for vehicle detection in 2015, Region Proposal Network (RPN) as a Region of Interest (RoI) candidate extractor, utilize the region proposal network to achieve competitive performance according to the vehicle detection benchmark. Detection Network is the R-CNN which takes input as the feature maps from the convolutional layer and the RPN network. This generates the bounding boxes and the class of the object. Ren et al. [16], Faster R-CNN used RPN(Region Proposal Network) along with Fast R-CNN for multiple image classification, detection and segmentation, 3-D object detection, part-based detection, instance segmentation and image captioning.

YOLO[17], a new approach to object detection. Prior work on object detection repurposes classifiers to perform detection. YOLO learns very general representations of object. , C.-Y. Fu et al.[19],DSSD model is able to outperform the previous SSD [17] framework, especially on small object or context specific objects, while still preserving comparable speed to other detectors. While we only apply our encoder-decoder hourglass model to the SSD framework, this approach can be applied to other detection methods, such as the R-CNN series methods [9,15,16]. T.-Y. Lin et al. [24], Feature pyramids are a basic component in recognition systems for detecting objects at different scales, deep ConvNets and their implicit robustness to scale variation, it is still critical to explicitly address multiscale problems using pyramid representations. Ren Y et al.[27], modified Faster R-CNN algorithm improves the mean average precision by a large margin on detecting small remote sensing objects and also to deal with the small object detection problem in optical remote sensing images, produce a single high-level feature map of a fine resolution as the final shared feature output, which is very critical to enable us to detect small remote sensing objects.

Liang et al.[29], classification stage, dense convolutional network is used to strengthen the feature transmission and multiplexing, which leads to more accurate classification with fewer parameters. We experiment with the challenging Tsinghua-Tencent 100K benchmark, and the evaluations demonstrate a significant performance improvement in detection. Xiaowei Hu et al.[30], scale-sensitive in object detection task but it is common that traffic images and videos contain vehicles with a large variance of scales. In this paper, we delve into the source of scale sensitivity, and reveal two key issues: 1) existing RoI pooling destroys the structure of small scale objects, 2) the large intra-class distance for a large variance of scales exceeds the representation capability of a single network. Based on these findings, we present a scale-insensitive convolutional neural network (SINet) for fast detecting vehicles with a large variance of scales.

Zhaowei Cai, et al.[31], A multi-stage object detection architecture, the Cascade R-CNN, composed of a sequence of detectors trained with increasing IoU thresholds, the Cascade R-CNN is generalized to instance segmentation, with nontrivial improvements over the Mask R-CNN. Zakaria et al.[32] to detect, locate, and automatically recognize vehicles in video sequences, The extracted features are used also to classify vehicle occlusions in order to eliminate them. The proposed method can handle illumination changes and

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# ANALYSIS OF PREY PREDATOR MODEL USING GRAPH DIFFERENTIAL EQUATIONS

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**Abstract:** In this paper, we introduce new concepts like a pseudo simple graph, the study of graph differential equations or equivalently matrix differential equations. We formulate a matrix differential equation for the famous prey predator model and Criteria are obtained to guarantee the existence of a solution and an iterative technique for convergence to the solution of a matrix differential equation is developed.

**Key Words and Phrases:** Simple Graph, Pseudo simple graph, graph differential equation, matrix differential equation and prey predator model.

## Introduction

Any natural or a man made system involves interconnections between its constituents, thus forming a network, which can be expressed by a graph [1, 2, 3]. Graphs arise naturally when trying to model organizational structures in social sciences. It has been noted that a graph which is static in nature is not suitable for social phenomena whose changes with time are natural. This led to the introduction of a dynamic graph and a Graph Differential Equation (GDE) in [2]. The introduced concepts were successfully utilized to study stability of complex dynamic systems through its associated adjacency matrix [2].

In [3] we have utilized the concepts defined in [2] including a graph linear space and its associated matrix linear space. Using the notion of a dynamic graph and the graph differential equations we observed that the study of GDEs falls into the realm of differential equations in abstract spaces. This study, through highly mathematical, would be of little use for practical problems. On the other hand, if we consider the associated matrix differential equation (MDE) then the approach appeared more reasonable and practical for the study of GDEs. Hence in [3], we considered a weighted directed simple graph as the basic element and developed the theory. We have obtained existence and uniqueness of solutions of a GDE through its associated MDE using the monotone iterative technique.

In [4] through we have developed significant results, the basic concept involved was weighted directed simple graph. Since a simple graph has no loops, this fact when translated into differential equations frame work states that there is no way to accommodate the rate of change of an edge $e_{ii}$ and its relation with other edges including the edge $e_{ii}$ . This is a drawback that had to be handled to model physical phenomena using graph differential equations, which called for a new concept that we plan to introduce in this paper.

Further, since there exists an isomorphism between graphs and their adjacency matrices, we successfully exploited it and defined the product of two graphs. A good example, will go a long way in support of the theory, we have considered the prey predator problem and developed the corresponding matrix differential equation and showed how the nonlinearity is preserved in this set up.

The rest of the paper is as follows. In section two, we introduce the concepts of pseudo simple graph and product of two graphs and have obtained a result that can be of practical importance in this set up.

In section three we obtained the matrix differential equation for prey predator problem and extended it to three species and further generalized it. In section four we conclude our work.


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