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Transportation Planning and Optimal Roadway Configuration: A Review

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ABSTRACT

Urban planning is a challenge with commuting playing a major role. Transport is important because it enables trade between persons, which is essential for the development of civilizations. Intelligent transportation systems (ITS) are in vogue and much literature is centered around ITS. Predictive models, clustering in data mining are usually incorporated in ITS study. This paper presents a review of 30 articles surrounding ITS, Prediction and models for transportation management.

KEYWORDS: *Urban planning, Intelligent Transportation System, prediction, clustering*

I. INTRODUCTION

Local transport systems worldwide are facing significant challenges, many of which relate to the private car. Challenges in car-sharing industry such as free-floating and competition are a determinant for demand and pricing of car sharing industry [1]. In particular, whilst increasing car ownership and use has obviously delivered significant benefits to individuals, at the societal level it has also led to an array of economic, social and environmental impacts which require the attention of policy makers. In this regard, it should be noted that rural areas face a number of distinct challenges. Phase transitions in a phase diagram provide insights into traffic dynamics, static bottleneck on the road can also be analyzed [2]. LWR traffic model is used for analysis.

For most urban road networks, severe traffic congestion would be incurred at signal-controlled junctions by road travelers as a result of inappropriate design of signal settings when uncertain travel demand is prevailing. Congestion pricing for system optimum flow has long been regarded as the most efficient instrument to mitigate traffic congestion and achieve efficient use of road network [3] [4]. Travel demand and traffic flow congestion is resolved through bi-level min-max program [3]. Activity based travel plan model using operational research techniques are discussed [4]. Investments in the transport sector are hallmarked by a long term life span and high investment costs. Due to restricted public financial resources not all transport projects are realizable and they have to be economically appraised. For this purpose different methodical approaches exist. The most important concept is the cost-benefit analysis, which is preferentially used worldwide, modal choice modeling based on traveler segmentation can help in transport policy decision making, cluster analysis, principal component analysis, common factor analysis, correspondence analysis is used to derive relationship between the travel parameters [5]. Phenomena of recurrent and non-recurrent congestion in freeway systems can be relieved by applying proper control techniques that have been studied by researchers for some

decades, Random Utility Model (RUM) for travel cost and site drop-off recycling relationship is derived [6].

A very successful and widespread control measure is ramp metering, which allows controlling the traffic flow entering the freeway mainstream by using traffic lights at the onramps [7].

Social activities and mobility are important aspects of quality of life for the elderly. Increasing age is found to be associated with decreasing mobility: older people are found to travel less than younger people in terms of trips per day and distance traveled [8] [9]. Demand uncertainty here refers to the uncertainty of travel demand in the future, which could be attributed to uncertain developments of the socioeconomic system or prediction errors in travel demand modeling etc. The problem of interest is the following: subject to a given budget, determine which links from a network need improvement (capacity increase) and decide how much budget should be allocated to the links so as to maximize the improvements in both efficiency (total system travel time) and robustness (to be defined) of the network [10].

STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms, objectives and overall description. In Section 2 we discuss related work. In Section 3 we have the complete information about image processing tools. Section 4 shares information about the flexible YAML templating system created for it, its advantages and disadvantages. Section 5 tells us about the methodology and the process description. Section 6 tells us about the future scope and concludes the paper with acknowledgement and references.

OBJECTIVES

The predominant invoice processing systems are either entirely manual or they follow a rigid single template system. Whether an individual is a buyer or a seller, this leads to a lot of inefficiencies and high costs.

This project aims to address some of the problems in current systems by greatly minimizing the human intervention in the process and thus reducing costs and errors. The aim is to ease the task of both the buyer and the seller.

II. RELATED WORK

Sonja et al. [11] proposed: "different ways of reducing the complexity and heterogeneity of the whole population by dividing it intorelevant subgroups were described. A special focus was put on attitude-based market segmentations, which have significantly increased in the recent years. They are compared with behaviour-based, socio-demographic and geographical approaches regarding selected marketing criteria inorder to provide support in the choice of the appropriateapproach for different fields of applications. That review highlights advances in the understanding of mode choice from a psychological perspective, taking into account behavioural theories of car use and car-use reduction."

Margareta et al. [12] attempted to: "apply a new variant of adaptive differential evolution technique on a real world data set to find optimal number of clusters at runtime.In that exploration dynamic clustering using ADE called DCADE, had been used to obtain the optimal number of clusters at runtime. DCADE algorithm was applied on a real time data known as Home Interview Survey (HIS) data which was related to a Transport Project. Later clusters are formed and analyzed which are in accordance with the domain expert."

Hong et al. [25] proposed: a "procedure of lifestyle classification that moves from specific surveys to a general population. That paper first studies issues related to the development of homogeneous clusters using socioeconomic, demographic and activity-travel data. Study also addresses the issue of data insufficiency and points out that in order to use the clusters developed for travel demand estimation, it was important to know how to allocate individuals in the population to the developed clusters. As a first attempt, that paper proposed to use a recently developed technique called, Support Vector Machine (SVM), to develop classification functions that based on readily available information only. The methodologies proposed are applied to a sub-urban area in Hong Kong. Six lifestyle clusters are first produced using factor analysis and cluster analysis. SVM was then used to develop classification functions that are based on fewer variables. Results show that the two sets of lifestyle clusters were similar and that the SVM outperforms other traditional classification methods."

Alfréd Csikós et al. [26] In this work: "a control system is developed and analyzed for the suppression of moving jamwaves and the reduction of pollutant concentrations near motorways. The system is based on the second-order macroscopic freeway traffic model METANET, joined by an emission dispersion model, introduced in a previous work of the authors. For the control tasks dedicated controllers are designed, both using the nonlinear model predictive control method. The control objectives require a distinction in the utilized control measures, thus different controllers are designed and used in predefined control modes. The first mode of the controller is responsible for keeping pollutant concentrations below prescribed limits under stable conditions. The second mode of the controller is working in case of a shockwave threat, aiming for traffic stabilization. Between the control modes switching is based on an appropriate rule set that satisfies the stability of the controlled system. The hybrid controller structure is realized by a finite automata. A complex case study is presented for the evaluation of the suggested controller."

Yuan et al. [27] attempted: "Piezo-actuated drop-on-demand jet dispensing technology is an essential method to distribute precision volume liquid in many processes of microelectronic packaging. To meet up the fast development of microelectronic packaging in the last decade and to facilitate producing efficiency, fluid dispensing has shown clear trend in its faster speed, smaller dispensing volume. This paper proposes a type of flexible hinge displacement amplifier (FHDA) for micro-displacement amplification of a piezo-actuator to realize high-frequency jetting dispensing. The article analyzes the influence of each parameter on the amplification ratio through ANSYS simulation, and gives the influence of each parameter on the input and output stiffness. Based on the proposed flexible hinge displacement amplifier, a piezo-actuated jet dispensing experimental mechanism and control system were built up in our lab. The performance of the piezo-actuator and the performance of flexible hinge displacement amplifier were tested."

Sesham Anand et al. [28] proposed: "Planning a trip not only depends on the travelling cost, time and path, but also on the socio-economic status of the traveller. This paper introduced a new trip-planning model that is able to work on real time data with multiple socio-economic constraints. The trip planning model processes the real time data and it is followed by the extraction of the relevant socio-economic attributes to mine the most frequent and the feasible attribute to plan the trip. Correlation defines the relevance of the socio-economic constraints, whereas the frequent and the feasible attributes are mined using the sequential pattern mining approach."

Sesham Anand et al. [29] identified: "Planning a trip not only depends on the traveling cost, time, and path, but also on the socio-economic status of the traveler. This paper introduced a new trip planning model that is able to work on real-time data with multiple socio-economic constraints. Real-time travel information of about 38,303 trips was acquired from the Indian city of Hyderabad, and the proposed model was subjected to experimentation. The proposed model maintained a substantial trade-off between multiple performance metrics, though the trip mean model performed statistically."

Sesham Anand et al. [30] studied: "Data mining techniques support numerous applications of intelligent transportation systems (ITSs). This paper critically reviews various data mining techniques for achieving trip planning in ITSs. The literature review starts with the discussion on the contributions of descriptive and predictive mining techniques in ITSs, and later continues on the contributions of the clustering techniques. Being the largely used approach, the use of cluster analysis in ITSs is assessed. However, big data analysis is risky with clustering methods. Thus, evolutionary computational algorithms are used for data mining. Though unsupervised clustering models are widely used, drawbacks such as selection of optimal number of clustering points, defining termination criterion, and lack of objective function also occur. Eventually, various drawbacks of evolutionary computational algorithm are also addressed in this paper."

Table I lists out the rest of the article proposal algorithms and purposes

TABLE –I Algorithms and Purpose

	Algorithm/ Model	Purpose
Chao Yang *et al.* [13]	K-means clustering based on lisence plate recognition (LPR)	Vehicle travel patterns, Extract the travel characteristics of vehicles instead of the estimation of the OD matrix
Wang *et al.* [14]	LASSO Algorithm	Predicting breast cancer risk using raw digital mammograms.
Arvind Kumar *et al.* [15]	Hydrodynamic traffic flow model	Effect significantly enhances the stability of traffic flow for any value of reactive coefficient of flux difference
Francisco Ruiz *et al.* [16]	Stochastic gradient optimization	Contribute to urban planning debates about zoning and transportation
Ceccato *et al.* [17]	Binary Logit Models	Analyze the interaction of car sharing with the existing offer of competing modes
Yue Li *et al.* [18]	Sustainability accounting	Sustainability accounting
Papageorgiou *et al.* [19]	The adopted numerical algorithm	Regulation of freeway traffic by means of optimal control techniques
P. Typaldos *et al.* [20]	Feasible direction algorithm	Minimization of fuel consumption of a vehicle, by optimizing its kinematic trajectories
Márton Tamás *et al.* [21]	Dijkstra's and Yen's Algorithm	Routing approach that allows automated vehicles to travel on different paths between given points, minimizing the generalized cost of the route.
Yang Yue *et al.* [22]	POI-based mixed use and neighbourhood vibrancy	Influence of density on neighbourhood vibrancy
Y. Luo *et al.* [23]	Recursive algorithm	RF energy harvesting communications
Hongzhi Li *et al.* [24]	Ingenuity Pathway Analyses	RLIP76 inhibition in combination with 2HF could be directly relevant to therapeutic management of BC

VI. FUTURE SCOPE AND CONCLUSION

This paper reviewed 30 articles related to intelligent transportation system, mechanisms such as prediction, clustering algorithms to optimize ITS and reduce transportation challenges.

The future work involves an attempt to apply a new variant of adaptive differential evolution technique on a real world data set to find optimal number of clusters at runtime. In this exploration dynamic clustering using ADE called DCADE is proposed to use to obtain the optimal number of clusters. DCADE algorithm will be applied on a real time data known as Home Interview Survey (HIS) data which is related to a Transport Project. Later clusters will be formed and analyzed.

The proposed methodology also will deal with the problem of finding the optimal roadway segment configuration for road based surveillance technologies to estimate route travel times accurately. In the second phase, the direction in investigating the travel time estimation problem concentrate towards the development of complex estimation algorithms and vehicletrajectory functions, but should be towards finding the segments for minimizing travel time estimation errors.

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