Surveillance Rapid Detection of Signs of Traffic Services in Real Time
Mohammad Alodat\textsuperscript{a,*}, Iyas Abdullah\textsuperscript{b}
\textsuperscript{a} IST Department - Sur Collage University, Oman
\textsuperscript{b} Jarash, Jordan

\textbf{Abstract:} The aim of this research study is to analyze the efficiency polygamy technology in detecting signs of traffic services in real time in different road conditions by comparing it with human eyes. A total of 204 observations were obtained to measure the effectiveness of the study program, by comparing program efficiency in different road conditions compared to human eyes. This system is useful in making driving safer and more enjoyable and helps observers to manage the violations of driving rules on crowded highways. Comparing the poor data obtained by human eye, Fusion or Polygamy Technology is more efficient in understanding the surrounding environment, supporting safe driving, and overcoming human defects. In order to realize all aspects of the road, a model was proposed: Intuitionistic Fuzzy Set (IFS).

\textbf{Keywords:} Fuzzy logic, Intuitionistic Fuzzy Sets, Intuitionistic Fuzzy Database.

\section{1. INTRODUCTION}
Congestion and the huge increase in the number of vehicles have become a major worry in many countries, as this expansion sometimes became a barrier to control the ambulance drivers, police, and the decision-maker. The unjustified use of vehicles during the period of traffic congestion might affect negatively the flow of traffic, such as the hunt for a parking place or taking inappropriate ways. Currently, vehicle drivers are using their naked eyes to read road signs and dealing with different road conditions. The difficulties that might be faced by drivers the inability of the human eye to detect and the rapid realization of road signs, sudden congestion and dynamic and static obstacles of the roads (Patel, 2013; Jin et al. 2012; Gaddam et al., 2014; Wang et al., 2004).

Dynamic obstacles are the movement of targets such as automobile, vehicle, pedestrians, and domestic animals. Detection of obstacles is not adequate for drivers they must be capable to support safe driving and overcome the drawbacks, through understand the surroundings in the roads, such as :1) External change for drivers such as weather conditions, varying lighting, ubiquitous shadows, and brightness intensity. 2) A variation of the shape signs of traffic and texture (Sturgess et al, 2009; Jarašūniene, 2007). The brightness fluctuations Increases at sunset and sunrise and the entrance and exit tunnels and it becomes difficult treatment and the detection about road signs, road edges, and vehicle plate, even with the use of sensors (radar, laser scanner and cameras) because are susceptible to shake (Sturgess et al, 2009; Jarašūniene, 2007), as shown in Figure 1.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{The degrees of illumination and shadows}
\end{figure}

\section{2. FUZZY LOGIC AND LEARNING}
Human knowledge is an analysis of complex information in order to find solutions and this information is vague concepts and imprecise and uncertain (Jha & Shukla, 2014; Liu, Chen, & Yang, 2008; Azimirad, Pariz, & Sistani, 2010). Fuzzy logic is a deeper concept of the classic (crisp) true and false, or black-and-white
Include matter of Degree of membership, such as Human Knowledge.

Information can be classified into numerical and linguistic data, as follows: 1) Numerical Information is obtained from mathematical models, physical laws or digital data collected by detectors. 2) Linguistic Information refers to the subjective information that is represented by the rules or linguistic terms based on the experience and knowledge collected from experts. To design a fuzzy control system the following steps are required: 1) Choosing the fuzzy controller inputs and outputs. 2) Choosing the pre-processing that is needed for the controller inputs and possibly post-processing that is needed for the outputs. 3) Designing each of the four components of the fuzzy controller, it is Rule-Base, the Inference Mechanism, the Fuzzification Interface and the Defuzzification.

3. TYPES OF INTUITIONISTIC

The Intuitionistic fuzzy set (IFS) is a part of Zadeh’s fuzzy set, developed by Atanassov (Szmidt, & Kacprzyk, 2001). An IFS is more general and comprehensive than fuzzy set and a powerful tool. It works to deal with vagueness. Connectedness concepts help to find the Cut Node (CN) in fuzzy graphs. CutNode (CN) is useful for identifying areas of density when choosing a path that does not contain node CN. The fuzzy logic is used to represent imprecise data which are called an Intuitionistic fuzzy database (IFDB). Interval-Valued Fuzzy Sets (IVFS) is more adequate of uncertainty and wider than traditional, fuzzy sets and Intuitionistic fuzzy set (IFS).

3.1. Intuitionistic Fuzzy Sets

The Intuitionistic Fuzzy Set (IFS) developed by Atanassov, is a powerful tool to deal with vagueness and use it more general and comprehensive than fuzzy set. The IFS constitutes an extension of Zadeh’s fuzzy set, and assigns to each element of membership degree. Applications of IFS for artificial intelligence are used with expert systems, neural networks, decision making, machine learning, and semantic representations. Intuitionistic Fuzzy Sets (IFS) have two values and they are \( \mu_{A(x)} \) and \( \nu_{A(x)} \). \( \mu_{A(x)} \) is a degree of membership. \( \nu_{A(x)} \) is a degree of non-membership. The sum of the two values has to be less than one (1), we introduce some definitions from IFS, which are necessary for our research; it can be expressed as follows: IFS \( A=(x, \mu_{A(x)}, \nu_{A(x)}, \Pi_{A(x)}): x \in X \).

3.2. Intuitionist Fuzzy Database

To find inaccurate information to extract more accurate conclusion and minimize the search we use Intuitionistic Fuzzy Set. We present an example of vehicle driver to take a decision within seconds recognizing the vehicle plate. The fuzzy logic is used to represent imprecise data and it is called an Intuitionistic Fuzzy Data Base (IFDB) (Kolev, Chountas, Petrounias, & Kodogiannis, 2005).

We introduce an application or case that using the intuitionistic fuzzy relation as following: 1) Intuitionistic Fuzzy Tolerance Relation. 2) Intuitionistic Fuzzy Similarity Relation (Equivalence). We constitute the IFS tolerance relation and equivalence of the attributes included database to reduce doubt ours. An intuitionistic Fuzzy Relation R on the Cartesian product \( X \times X \), is called: An Intuitionistic Fuzzy Tolerance Relation if R is reflexive and symmetric relation. An Intuitionistic Fuzzy Similarity (Equivalence) Relation if R is reflexive, symmetric and transitive relation, as following:

- Reflexive relation \( \forall x \in A \Rightarrow \mu R(x,x)=1 \).
- Symmetric relation \( \forall \ (x,y) \in A \times A , \mu R(x,y)=\mu \Rightarrow \mu R(y,x)=\mu \).
- Transitive relation \( \forall \ (x,y),(y,z),(x,z) \in A \times A \mu R(x,z) \geq \text{Max} [\mu R(x,y), \mu R(y,z)] \).

3.3. Interval-Valued Intuitionistic Fuzzy Set

Interval values intuitionistic Fuzzy Sets (IVIFS) are extensions of the theory of fuzzy sets and others are trying to cope inaccuracy and uncertainty differently (Wei, Wang, & Zhang, 2011). IVIFS can be expressed as follows:

\( A=(x, (D(x), J(x), H(x))): x \in X \in [I] \).

Where define the symbols as follows:

\( D(x), J(x) \) and \( H(x): X \rightarrow [I] \) represent the degree of membership and non-membership and the hesitation part (Error), of the element \( x \rightarrow X \), respectively.

Let \([I]\) be the set of all closed subintervals of the interval \([0,1]\)

\( D(x) = [\mu_{1*}, \mu_{1^*}] \in [I] \)

\( J(x) = [\mu_{2*}, \mu_{2^*}] \in [I] \).
0 ≤ \([\sup (D(x), \mu_1^a)] + [\sup (J(x), \mu_2^a)] ≤ 1\), \(\forall x \in X\). \(\mu_1^a\) and \(\mu_1^{a+}\) are the lower extreme, \(\mu_2^a\) and \(\mu_2^{a+}\) the upper extreme, respectively. So, \(A= (\mu_1^a, \mu_1^{a+}], [\mu_2^a, \mu_2^{a+}], [\mu_1^{aH}, \mu_1^{aH+}])\).

4. RESULTS

4.1. License Plates at Intelligent Technology

The image Vehicle plate is a square matrix containing the cells in the form of columns and rows and each cell represents a pixel (single point within the image). Converting the image to black and white for simplifying the color information and reduce the file size. The problems facing Vehicle plate may be insects, dirt, reflective material and brightness. In order to find out all the existing characters on the plate of the vehicle. We use Fusion or Polygamy Technology with Fuzzy Logic, Neural Network, and Genetic Algorithm. Neural network receives the character and shows the primary key which refers to the image in the database, as shown in Figure 2.

![Fig.2. Compare with database and recognition](image)

4.2. Measure the effectiveness

A total of 204 observations were obtained to measure the effectiveness of the study program, by comparing program efficiency in different road conditions compared to human eyes. observations were obtained in 13 road conditions, of them 5.9% were observed in day light, 11.8% moon light and festive night, 17.9% observed with insects over vehicle plate, 5.9% were obtained in reflective light, dirt over plate, brightness, sunset, rainy weather, sunrise, foggy weather, mid-day light, and in snowy weather, as shown in Figure 3.

![Fig.3. Comparing program efficiency in road condition](image)

The study program was tested for its effectiveness by comparing its efficiency in reading the vehicle plate suitably in different road conditions compared to the efficiency of human eyes in reading vehicle plate in same road conditions. The study found that the program was 78% able to read vehicle plate suitably while human eyes were 16% able to read the plate in suitable way, as shown in Figure 4.

![Fig.4. comparing its efficiency in reading the vehicle plate suitably in same road conditions](image)

In terms of the program ability to save time, statistical analysis found that the time needed by the program to read the plate range from 3 seconds to 5 seconds and the mean time was 3.42 seconds. However, the time needed by human eyes ranged from 3 seconds to 15 seconds, and the mean time needed was 9.91
seconds, which clearly indicate the efficiency of study program in saving time compared to human eyes, as shown in Figure 5.

![Graph](image)

**Fig. 5.** Comparing efficiency of study program in saving time with human eyes.

Statistical analysis was done to test the suitability of the study program in different road conditions in detailed way. The study program was 100% suitable in reading vehicle plate in daylight compared to human eyes who scored only 16.7% suitable readings for plates. Moreover, this program scored 83.3% suitability in reading vehicle plates in different road conditions including: reflective light, bright light, rainy weather, foggy, sunset time, mid-day time, snowy weather, and festive night, while human eyes scores are not exceeding (0%-16.7%) suitable scores in same road conditions.

Furthermore, reading plates with insects covering the number plates has scored better when utilizing the program compared to human eyes, as the study program scored 72.2% while human eyes scored only 11.1% suitability. Measuring suitability in sunrise and with dirt over the plate shows that the program was 66.7% suitable but human eyes didn’t exceed (16.7% - 50%) in same conditions, as shown in Figure 6.

![Cumulative Percent Wrong](image)

**Fig. 6.** The suitability of the study program in road conditions.

### 5. CONCLUSIONS

This paper shows the study of Polygamy Technology to create system capable for learning, and not rely on the human eye. One model has been proposed to extract the best to recognize the vehicle plate is shown that: Intuitionistic Fuzzy Set (IFS) is more adequate. Vehicle plate analysis in real time has helped to give priority such as, ambulance, firefighter, and police to cross intersections and checkpoints and search for stolen vehicles in different climatic conditions. In future studies, we will develop a learning algorithm and apply to the Parked Vehicles with searching for vacant places without losing time save fuel and prevent of stealing vehicles.

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### REFERENCES


