An Application of Fuzzy Value Assignment In A Relation In Two Wheeler Road Accident Non Wearing Helmet Death Details

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Abstract: The most important feature of data manipulation is the valve assignment in relation to the similarity method. When it comes to changing values and specifying direction, this method is extremely accurate. The primary source of data for this study is the 2019 two-wheeler non-helmet death list. Every day, there is a new accident. On the other hand, bicycle injuries are at an all-time high among this generation's riders. In this article, we'll examine the number of non-helmet two-wheeler accidents each month, month by month, and rotation by rotation.

Keywords: accident data, fuzzy relation, Similarity method, Cosine Amplitude, fuzzy soft matrix, Transitive closure

1. Introduction

In January, 993 people died in road accidents, the majority of which occurred on Tamil Nadu national and state highways. Is there a downside to building bigger, wider roads? Yes, if adequate safety features are not provided, particularly given that motorists drive at higher speeds on wider roads. According to recent data on road accidents in Tamil Nadu for the month of January, deaths from road accidents are lower on narrow roads than on wider roads.

Between January 1 and December 31, over 70% of all accidental deaths in the state occurred on state and national highways. In January 2019, 993 people died in 5,173 road collisions, according to official statistics from the State Crime Records Bureau (SCRB). The number of fatalities for the same time last year was 1.189, with 360 deaths on the National Highway and 332 on the State Highway – 36.25 percent and 33.43 percent, respectively. While State Highway have a width of 20-60 feet and National Highways 60-200 feet, district and village roads point out that higher fatalities on highways is due to lack of safety features.

"Various steps and stringent action against violations have decreased fatalities, but due to the lack of a safety element, a sudden decrease in deaths is not possible", they say. For example, despite the fact that National Highways are supposed to be fenced on both sides, some stretches are still accessible for a variety of reasons.

"Many important junctions have yet to receive flyovers or underpasses due to local opposition to land acquisition and other issues. The accident rate is low significantly if these problems are resolved, according to officials from the National Highways Administration. State highways are in a similar poor condition. About 2,500 kilometer of district roads have been upgraded as State Highways in the last 20 years, but many of them lack a median.

The overall length of the State highway system is 11,830 kilometers, with 9416 kilometers of double lane (20 feet) roads, 2084 kilometers of multi-lane (40 feet), 291 kilometers of intermediate lane (15 to 20 feet), and 39 kilometers of single lane roads (10 to 15 feet).

"With the exception of roads passing through Chennai, Madurai, Coimbatore, PTKI, and other towns, over 90% of State Highways have no median. According to highways sources, a plan to install dividers at accident-prone locations has been submitted to the government. The previous year's corresponding era had a much higher number of 1,189. There were 360 deaths on National Highways and 332 deaths on State Highways, accounting for 36.25 percent and 33.43 percent, respectively.

Although state highways are 20-60 feet wide and national highways are 60-200 feet wide, district and village roads are only 10-30 feet wide. Officials say that the lack of safety features on highways is to blame for the higher number of fatalities.

On Indian highways, road accidents are one of the leading causes of death. According to media reports, one person is killed in a road accident every four minutes in India. Bad roads, reckless user conduct, faulty road design and infrastructure, inadequate implementation of traffic laws, and a lack of rapid trauma treatment are all factors contributing to India's unusually high number of on-road fatalities.

The Motor Vehicles Act of 1988 (MVA), India's only law governing road safety, has proven ineffective in effectively resolving any of the aforementioned issues. Road safety is still not regarded as a top priority in the region.

The country's condition will be improved by enacting a comprehensive national road safety law. The Ministry of Surface Transportation recently revised the MVA Act to include more strict penalties and punishments for violating driving laws.

In January, there were 689 injuries and 114 fatalities. According to data collected in 32 districts across the state in January this year, the city continues to lead in the number of road injuries and deaths.

According to the Transport and Road Safety Commissioner's survey, "Road Accidents Analysis in Tamil Nadu January 2019," Chennai leads the state with 689 road accidents out of a total of 5,173 for the month of January, as well as 114 fatalities out of a total of 993 deaths.

In January 2018, the city of Chennai had the most injuries (611) and deaths (103). With 297 incidents and 777 deaths, kanchipuram falls in second.

The good news is that the overall number of injuries and fatalities in January this year was smaller than in January last year. The total number of injuries registered this year is 5,173, compared to 5,798 last year. This year's deaths totaled 993, compared to 1,189 the previous year.

Despite the fact that the Supreme Court committee on road safety has taken a range of disciplinary measures to reduce incidents, data shows that the overall number of accidents and deaths has decreased over the last two years.

In its effort to curb road deaths, the Supreme Court Committee on Road Safety has used the suspension of driving privileges as a trump card. During this time, drivers' license are revoked for a number of traffic offences, including speeding, texting while driving, overcrowding, and drunken driving.

The road safety committee has been actively suspending driving for the past two years, according to a Transportation and Road Safety Department official. The largest number of driving licenses cancellations has been recommended by the traffic police among those who use their phones when driving. Although the number of driving licenses revoked due to traffic violations for using cell phones was 57,158 in 2017, it more than doubled to 1,26,181 in 2018. Chennai is the city with the most district-level driving licenses cancellations for various traffic violations.

The surprising thing about the data on the six causes of injuries, which include driver error, pedestrian error, bad route, and mechanical defects, is that driver error remains the leading cause of accidents, accounting for 5,099 of the total 5,173 accidents.

Just three districts in Tamil Nadu, TN, PDKI, and PTKI, are being targeted for maximum two-wheeler accidents and deaths.

For this routine road accident analysis in Tamil Nadu (TN, PDKI, PTKI), we use data from the Road Accident Data Management System. Even with data from the 1081 TN, PDKI, and PTKI police forces.

I. VALUE ASSIGNMENTS IN A RELATION:

The importance of using fuzzy relations in accident descriptions is discussed. Fuzzy matrix was one of the key growths of fuzzy set theory, and it was mostly used to discuss and reason for a specific type of matrix.

There are at least seven different methods for generating the numerical values that define a relationship (i) Closed type expression (ii) Lookup table (iii) Cartesian product (iv) Laws of understanding based on linguistics (v) Groupings (vi) Input/output data-driven automated methods (vii) Data manipulation of similarity approaches.

The Cartesian product, the first form, has already been discussed in depth. Another method is to simply observe a physical action. We see a mechanism that generates a set of inputs based on a set of inputs. If there is no difference between unique input-output pairs, we can be directed to model the process with a crisp relation. If there is some variance, membership values on the interval [0,1] can be used to establish a fuzzy relation using the third form, a look up table. Linguistic knowledge can also be used to create if-then laws that represent fuzzy relationships.

Similarly, we should cover the other projects. All of these measures use different matrices to try to locate a similar pattern or structure in data. The two most effective methods are as follows:

(I)Cosine Amplitude Method:

Let $\tilde{A} = \{\tilde{a}_1, \tilde{a}_2, ..., \tilde{a}_p\}$ be the collection of data in the form of array $\tilde{A}$, i.e.,

$$\tilde{A} = \{\tilde{a}_1, \tilde{a}_2, ..., \tilde{a}_p\}$$

Here, each element $\tilde{a}_i$ in the data array A is itself a vector of length q, i.e.,

$$\tilde{a}_i = \{\tilde{a}_{i1}, \tilde{a}_{i2}, ..., \tilde{a}_{iq}\}.$$

Each of the data samples can be thought of as a point in q-dimensional space. Where each points need m coordinates for a complete description. Each element of a relation, $\tilde{r}_{ij}$ results from a pair wise comparison of the data sample, say $\tilde{a}_i$ and $\tilde{a}_j$, where the strength of the relationship between data samples $\tilde{a}_i$ and $\tilde{a}_j$ is given by the membership values expressing that strength, i.e., $\tilde{r}_{ij} = \mu_{\tilde{R}}(\tilde{a}_i, \tilde{b}_j)$.

The relation matrix will be of size $p \times p$ and as will be the case for all similarity relations, the matrix will be reflexive and symmetric, hence a tolerance relation.

(a)Reflexivity:

Let $\tilde{R}$ be the fuzzy relation in $\tilde{X} \times \tilde{X}$.

(1) $\tilde{R}$ is called reflexive , if $\mu_{\tilde{R}}(\tilde{a},\tilde{a})=1 \quad \forall\ \tilde{a} \in \tilde{X}$

(2) $\tilde{R}$ is called ε-reflective, if $\mu_{\tilde{R}}(\tilde{a},\tilde{a}) \geq \varepsilon \ \forall\ \tilde{a} \in \tilde{X}$

(3) $\tilde{R}$ is called weakly reflexive , if

$$\left.\begin{aligned}\mu_{\tilde{R}}(\tilde{a},\tilde{b}) &\leq \mu_{\tilde{R}}(\tilde{a},\tilde{a}) \\ \mu_{\tilde{R}}(\tilde{b},\tilde{a}) &\leq \mu_{\tilde{R}}(\tilde{a},\tilde{a})\end{aligned}\right\} \quad \forall \tilde{a},\tilde{b} \in \tilde{X}$$

(b) Symmetry:

(1)A fuzzy relation $\tilde{R}$ is called symmetric if

$$\tilde{R}(\tilde{a},\tilde{b}) = \tilde{R}(\tilde{b},\tilde{a}) \quad \forall\ \tilde{a},\tilde{b} \in \tilde{X}.$$

$$\mu_{\tilde{R}}(\tilde{a},\tilde{b}) \neq \mu_{\tilde{R}}(\tilde{b},\tilde{a})$$

(2)A fuzzy relation is called antisymmetric if for $\tilde{a} \neq \tilde{b}$ either

$\forall\ \tilde{a},\tilde{b} \in \tilde{X}$ (or) $\mu_{\tilde{R}}(\tilde{a},\tilde{b}) = \mu_{\tilde{R}}(\tilde{b},\tilde{a})$

(3) A fuzzy relation is called perfectly anti symmetric if for $\tilde{a} \neq \tilde{b}$ whenever

$$\mu_{\tilde{R}}(\tilde{a},\tilde{b}) > 0 \text{ then } \mu_{\tilde{R}}(\tilde{b},\tilde{a}) = 0 \quad \forall \tilde{a},\tilde{b} \in \tilde{X}$$

(c) Tolerance Relation:

The fuzzy tolerance relation, also known as the resemblance relation, is a binary fuzzy relation with the properties of reflexivity and symmetry.

The cosine amplitude method calculates $\tilde{r}_{ij}$ by the following formula

$$\tilde{r}_{ij} = \frac{\left|\sum_{k=1}^{q} \tilde{a}_{ik}\tilde{a}_{jk}\right|}{\sqrt{\left(\sum_{k=1}^{q} \tilde{a}_{ik}^2\right)\left(\sum_{k=1}^{q} \tilde{a}_{jk}^2\right)}}$$ where i, j=1,2,…,n

2. Max-Min Method:

This method is different from max-min composition method. It is found through simple min and max operations on pairs of the data points $\tilde{a}_{ij}$ and is given by

$$\tilde{r}_{ij} = \frac{\sum_{k=1}^{q} \min(\tilde{a}_{ik},\tilde{a}_{jk})}{\sum_{k=1}^{q} \max(\tilde{a}_{ik},\tilde{a}_{jk})}, \quad \text{where i, j=1,2,…,n}$$

3. Methodology (I)

Consider that non-warning of helmets resulted in the largest number of deaths in the months of February, March, April, May, and June of 2019. For TN, PDKI, and PTKI, each element is collected in the main three districts.

	$\tilde{a}_1$	$\tilde{a}_2$	$\tilde{a}_3$	$\tilde{a}_4$	$\tilde{a}_5$

$\tilde{a}_{i1}$	0.1	0.4	0.5	0.3	0.1
$\tilde{a}_{i2}$	0.5	0.5	0.3	0.1	0.1
$\tilde{a}_{i3}$	0.6	0.6	0.4	0.3	0.6

For i=1, j=2 ,q=3

Consider the following relation

The cosine amplitude method calculates $\tilde{r}_{ij}$ by the following formula

$$\tilde{r}_{ij} = \frac{\left|\sum_{k=1}^{q} \tilde{a}_{ik}\tilde{a}_{jk}\right|}{\sqrt{\left(\sum_{k=1}^{q} \tilde{a}_{ik}^2\right)\left(\sum_{k=1}^{q} \tilde{a}_{jk}^2\right)}},$$

where i,j=1,2,…,n ……..(1)

Substitute the fuzzy relation values in formula.

For i=1, j=2 from (1), we get

$$r_{11} = 1$$

$$r_{12} = \frac{0.04 + 0.25 + 0.06}{\sqrt{(0.62)(0.42)}} = 0.1866$$

$$r_{12} = 0.187$$

Similarly, we can find the other elements. Thus, we can find the following tolerance relation

$$\tilde{R} = \begin{bmatrix} 1 & & & & \\ 0.187 & 1 & & & sym \\ 0.279 & 0.301 & 1 & & \\ 0.062 & 0.059 & 0.081 & 1 & \\ 0.203 & 0.264 & 0.172 & 0.192 & 1 \end{bmatrix}$$

And two compositions of $\tilde{R}$ produced the equivalence relation $\tilde{R}$.

We can find ,

(i) reflexive

(ii) symmetric

(iii) $\tilde{R} \circ \tilde{R}$

(iv) $\tilde{R} \circ \tilde{R} \cup \tilde{R}$

We can find out,

$$\tilde{R} \circ \tilde{R} = \begin{bmatrix} 1 & 0.187 & 0.279 & 0.062 & 0.203 \\ 0.187 & 1 & 0.301 & 0.059 & 0.264 \\ 0.279 & 0.301 & 1 & 0.081 & 0.172 \\ 0.062 & 0.059 & 0.081 & 1 & 0.192 \\ 0.203 & 0.264 & 0.172 & 0.192 & 1 \end{bmatrix} \circ \begin{bmatrix} 1 & 0.187 & 0.279 & 0.062 & 0.203 \\ 0.187 & 1 & 0.301 & 0.059 & 0.264 \\ 0.279 & 0.301 & 1 & 0.081 & 0.172 \\ 0.062 & 0.059 & 0.081 & 1 & 0.192 \\ 0.203 & 0.264 & 0.172 & 0.192 & 1 \end{bmatrix}$$

$$\tilde{R} \circ \tilde{R} = \begin{bmatrix} 1 & 0.279 & 0.279 & 0.192 & 0.203 \\ 0.279 & 1 & 0.301 & 0.192 & 0.264 \\ 0.279 & 0.301 & 1 & 0.172 & 0.264 \\ 0.192 & 0.192 & 0.172 & 1 & 0.192 \\ 0.203 & 0.264 & 0.264 & 0.192 & 1 \end{bmatrix}$$

$(\tilde{R} \circ \tilde{R}) \cup \tilde{R}$ *sub*

$$= \begin{bmatrix} 1 & 0.279 & 0.279 & 0.192 & 0.203 \\ 0.279 & 1 & 0.301 & 0.192 & 0.264 \\ 0.279 & 0.301 & 1 & 0.172 & 0.264 \\ 0.192 & 0.192 & 0.172 & 1 & 0.192 \\ 0.203 & 0.264 & 0.264 & 0.192 & 1 \end{bmatrix} \cup$$

$$\begin{bmatrix} 1 & 0.187 & 0.279 & 0.062 & 0.203 \\ 0.187 & 1 & 0.301 & 0.059 & 0.264 \\ 0.279 & 0.301 & 1 & 0.081 & 0.172 \\ 0.062 & 0.059 & 0.081 & 1 & 0.192 \\ 0.203 & 0.264 & 0.172 & 0.192 & 1 \end{bmatrix}$$

$$\tilde{R}' = \begin{bmatrix} 1 & 0.279 & 0.279 & 0.192 & 0.203 \\ 0.279 & 1 & 0.301 & 0.192 & 0.264 \\ 0.279 & 0.301 & 1 & 0.172 & 0.264 \\ 0.192 & 0.192 & 0.172 & 1 & 0.192 \\ 0.203 & 0.264 & 0.264 & 0.192 & 1 \end{bmatrix}$$

Since the reflexive and symmetric conditions are fulfilled in the above fuzzy relation, it is referred to as the tolerance relation. However, the equivalence relation is not met. Transitive Closure was fulfilled in the above fuzzy relation.

Here, $\tilde{R}'''' = \tilde{R}'''$. Thus $\tilde{R}''' = \tilde{R}_{\tilde{T}}$ the closure membership matrix.

METHODOLOGY (II)

Max-Min Rule is used in this approach. This is not the same as the max-min composition form. After that, think about methodology I link table. Same as meaning for $\tilde{a}_1, \tilde{a}_2, \tilde{a}_3, \tilde{a}_4, \tilde{a}_5$.

$$\tilde{r}_{ij} = \frac{\sum_{k=1}^{q} \min(\tilde{a}_{ik}, \tilde{a}_{jk})}{\sum_{k=1}^{q} \max(\tilde{a}_{ik}, \tilde{a}_{jk})},$$

where i,j=1,2,…,n ……(2)

For i=1, j=2 , q=3

Consider the relation table, we have

$$r_{12} = \frac{\sum_{k=1}^{3}\left[\min(0.1,0.4), \min(0.5,0.5), \min(0.6,0.1)\right]}{\sum_{k=1}^{3}\left[\max(0.1,0.4), \max(0.5,0.5), \max(0.6,0.1)\right]}$$

$$= \frac{0.1+0.5+0.1}{0.4+0.5+0.6} = \frac{0.7}{1.5} = 0.467$$

$$r_{12} = 0.467$$

Similarly, we may compute the another elements.

Hence, we get the following tolerance relation

$$\tilde{R} = \begin{bmatrix} 1 & & & & \\ 0.467 & 1 & & \textit{sym.} & \\ 0.5 & 0.571 & 1 & & \\ 0.357 & 0.417 & 0.583 & 1 & \\ 0.667 & 0.2 & 0.429 & 0.5 & 1 \end{bmatrix}$$

Since, the partnership has also fulfilled reflexive and symmetric requirements. It's the same thing as the tolerance relationship.

Here , $\tilde{R}^{''''} = \tilde{R}^{'''}$. Thus $\tilde{R}^{''''} = \tilde{R}_{\tilde{T}}$, the closure membership matrix.

The closure membership matrix is referred to as transitive closure in this case. Equivalence relation is the name given to the transitive closure.

4. Result:

- In January 2019, 993 people died in 5,173 road collisions, according to official statistics from the State Crime Records Bureau (SCRB).
- In the month of June 2019, 5209 road accidents were registered in the state of Tamil Nadu.
- Total two-wheeler accident 2058, with two-wheeler deaths accounting for 34.28 percent of all fatalities due to the failure to wear helmets.
- The fuzzy link table displays the number of deaths in each district as a result of not wearing a helmet.
- Final result (i) define,

	$\tilde{a}_1$	$\tilde{a}_2$	$\tilde{a}_3$	$\tilde{a}_4$	$\tilde{a}_5$
$\tilde{a}_1$	1	0.187	0.279	0.062	0.203
$\tilde{a}_2$	0.187	1	0.301	0.059	0.264
$\tilde{a}_3$	0.279	0.301	1	0.081	0.172
$\tilde{a}_4$	0.062	0.059	0.081	1	0.192
$\tilde{a}_5$	0.203	0.264	0.172	0.192	1

- And this matrix is both reflexive and symmetric. The tolerance relationship was fulfilled by these two factors. However, the transitive condition is not fulfilled. its transitive closure equivalence relation

Reflexive and symmetrical monthly road injury reports. Road accidents varies in severity and frequency. Accidents happen all the time on the road. A traffic

- accident is a transitive cosine amplitude termination.
- Result (ii) for Similarity method define,

	$\tilde{a}_1$	$\tilde{a}_2$	$\tilde{a}_3$	$\tilde{a}_4$	$\tilde{a}_5$
$\tilde{a}_1$	1	0.467	0.5	0.357	0.667

$\tilde{a}_2$	0.467	1	0.517	0.417	0.2
$\tilde{a}_3$	0.5	0.517	1	0.583	0.429
$\tilde{a}_4$	0.357	0.417	0.583	1	0.5
$\tilde{a}_5$	0.667	0.2	0.429	0.5	1

- The tolerance relationship is the product of the similarity process.
- This cosine amplitude and similarity (max-min) process is shown by the overall total accident.

5. Conclusion:

The most popular approaches are the cosine amplitude method and the max-min method. Since the input and processing of road accident data, as well as the output result, are 100% accurate. It is a hazy relationship. In India, there are many lists of the most common causes of road accidents. Distracted driving, drunk driving, speeding, not wearing a seat belt, storms or muddy roads, potholes and poor road conditions, violating traffic laws, and so on are all examples of unsafe driving. However, road accidents are unfortunately common in India, and the majority of them are caused by human error.

And one of the key reasons in this research paper two wheeler for not wearing a helmet is a road accident. This type of bike accident is on the rise, with no signs of slowing down. However, road driving laws and regulations are not following for young people aged 18 to 35.

As a result of these two methods, road accidents continue to occur. And, in a cyclical fashion, an accident happens. Its symmetrical and reflexive system. The human head is the most important part of the body to safeguard. As a consequence, wearing a helmet is important. According to my study, the number of injuries I've had in the last five months has remained unchanged. Man's irresponsibility is the cause. The value of wearing a helmet should be clearly explained in the RTO office before obtaining a licenses.

During vehicle inspections at customs, cyclists must wear a helmet. It must be put to the test. My next research project will look at the risks that an injury can pose to the human body. i.e., diseases that occur in the body and their consequences.

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