Profiles of Human Trafficking Violence in Regions of Ecuador

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Abstract. People are often vulnerable to become victims of violence, including human trafficking. In Ecuador, considerable crimes of this nature are reported each year. Knowing and generating protection mechanisms against this type of crime constitutes a vitally important task to preserve the integrity of people. This research proposes a solution to the problem described from the development of a method to determine profiles of violence in people from regions of Ecuador. The proposed method bases its operation on the set of neutrosophic numbers to represent the uncertainty.

Keywords: Violence profiles, neutrosophic numbers, multi-criteria decision-making method.

1. Introduction

Human trafficking crimes represent a global phenomenon that constitutes one of the most lucrative illegal activities, after drug and arms trafficking. According to United Nations estimates, more than 2.4 million people are currently being exploited as victims of human trafficking, either for sexual or labor exploitation.[1, 2].

Other forms of human trafficking include servitude, organ trafficking, and the exploitation of children for begging or for war. Up to 80% of victims of human trafficking are women and girls. Human trafficking is a crime against human rights considered as slavery of the 21st century[3, 4].

This crime consists of the forced or deceitful transfer of one or more people from their place of origin (whether internally in the country or transnationally), the total or partial deprivation of their freedom for labor, sexual or similar exploitation. This fact is due to the fact that the means through which a person has been captured to exercise a job have been coercion or deception [5, 6].

Poverty leads some poor rural families to send children to work on banana plantations or small mines or to send them to urban areas where traffickers exploit them. Ecuadorian citizens are trafficked to Western Europe, particularly Spain and Italy, and other Latin American countries [7-9].

The report issued by the United States Department of State for the Ecuador section in 2005 refers to the validity of these terms. In 2003, the International Labor Organization estimated that more than 5,000 minors were exploited in prostitution in Ecuador.

This research describes a neutrosophic method to determine profiles of human trafficking violence in regions of Ecuador. The method is a Decision Support System[10] model for the automatic search for human trafficking profiles, where the real profile of a region is compared with others stored in time. The advantage of the model is that once the profile is identified, it is easier to evaluate and more importantly, to determine how to proceed according to historical precedents. The inclusion of neutrosophic numbers allows modeling with the indeterminacy that is typical of all decision-making processes, as well as the use of a linguistic scale that is more suitable for evaluating people when compared to numerical scales[11-13].

This article is divided into a preliminary section that addresses the issue of human trafficking and the legal framework for dealing with this scourge, in addition to describing concepts such as the neutrosophic number. Section 3 introduces the proposed method; section 4 contains the application of the method to a real case. The paper ends with the conclusions.

2 Preliminaries

In order to understand the main references around the object of study of this research, the main terms associated with the problem that is modeled are described. The concepts of crimes of violence are introduced in the context

of the investigation along with the legal norms that support the citizen's right to prevent crimes of violence. Finally, a modeling is carried out on how to represent the uncertainty using neutrosophic numbers.

2.1 Crimes of violence

It constitutes a crime of human trafficking, even with the consent of the victim, to promote, induce, participate, facilitate or favor the recruitment, transfer, reception, reception or delivery of persons through threat, violence, deception or any other fraudulent form, for illicit exploitation, for profit or not for profit [14, 15].

For the purposes of this offense, all forms of forced labor or services, labor slavery, sale and/or use of people for begging, armed conflicts, or recruitment for criminal purposes are considered exploitation.

Remember that trafficking involves capturing, transporting or receiving a person where violence, deception and abuse of vulnerability are applied for the purpose of exploitation, for the purpose of generating illicit income for traffickers [16, 17].

The Executive Decree proposes the fight against different existing forms of exploitation, including sexual exploitation and the "prostitution of women, children, and adolescents". It is clear that when dealing with persons under 18 years of age, we must refer to paid sexual relations, as one of the manifestations of "child" sexual exploitation, although it also includes adolescents. The use of this concept has been internationally accepted, in order to avoid associating it with myths and stereotypes that consider prostitution as an activity of free choice on the part of those who exercise it. In addition, emphasis has been placed on differentiating from adult prostitution, to the extent that children and adolescents are within criminal networks of sexual exploitation [18].

2.2 Legal norms for the crime of violence

The Ecuadorian Penal Code establishes the legal norm to regulate crimes of violence [19, 20]. Article 188 of the Criminal Code, evidences the purposes for which a person can be violated, which can be listed as follows.

1. To be sold,
2. To be put against his/her will at the service of another,
3. To get any utility,
4. To ask for ransom,
5. To deliver a belonging,
6. To deliver or sign a document that has or may have legal effects,
7. To force her to do or omit something,
8. To force a third party to carry out one of the indicated acts aimed at the release of the plagiarist.

It is in this way that the violence of persons manifests itself as a means to obtain some of the ends determined by the law itself. It is unacceptable that a person is deprived of his freedom, with the sole purpose of obtaining an amount of money in exchange, with the aggravation that if their requirements are not met, the captors do not hesitate to murder the victim[21]. It is even more degrading when children or people who have no possibility of defense are used as targets [22].

2.3 Neutrosophic numbers to model the uncertainty in the commission of crimes

Neutrosophic sets are a generalization of a fuzzy set (spatially fuzzy intuitive set). Let U be a universe of discourse, and M a set included in U. An element x of U is denoted with respect to M as x (T, I, F), which means that x belongs to M in the following way: it is t% true in the set, i% undetermined in the set, and f% false, where t varies in T, i varies in I, f varies in F.

Statistically T, I, F are subsets, but dynamically T, I, F are functions or operations dependent on many unknown or known parameters [23, 24].

In order to facilitate the practical application to the decision-making and engineering problem[25, 26], the proposal of the neutrosophic single-valued sets (SVNN) was made [27] which allows the use of linguistic variables [28, 29] as a way to increase the interpretability in the recommendation models and the use of indeterminacy.

Let X be a universe of discourse. An SVNS A over X is an object of the form.

$$A = \{\langle x, u_A(x), r_A(x), v_A(x)\rangle : x \in X\} \qquad (1)$$

Where $u_A(x): X \to [0,1], r_A(x),: X \to [0,1]$ y $v_A(x): X \to [0,1]$ with $0 \le u_A(x) + r_A(x) + v_A(x): \le 3$ for all $x \in X$. The interval $u_A(x), r_A(x)$ and $v_A(x)$ denote the true, indeterminate, and false memberships of x in A, respectively. For convenience, an SVN number will be expressed as $A = (a, b, c)$, where $a, b, c \in [0,1]$, $0 \le a + b + c \le 3$.

3 Method to determine profiles of human trafficking violence in regions of Ecuador

The proposed method's workflow consist of three stages: Input, Processing and Output.

The core of the method's processing is designed in three main processes: determination of violence profiles, evaluation and classification of alternatives, and generation of recommendations based on the knowledge of the

similarity profile. Figure 1 shows a diagram with the general operation of the proposed method.
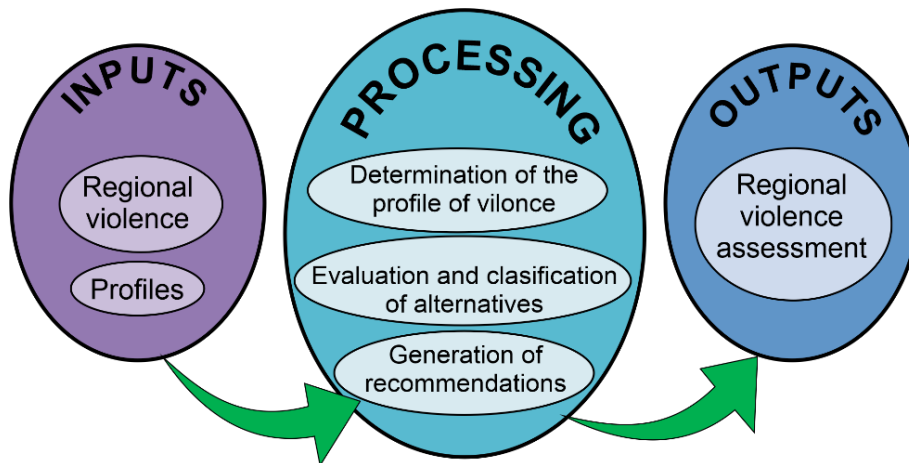

Figure 1: Structure of the operation of the proposed method.

The method operates through a knowledge-based recommendations system [30, 31]. We also implemented the representation of linguistic terms and indeterminacy through neutrosophic numbers[32].

Each of the stages of the method and the mathematical foundations that support the different processes are described below.

Determination of the database with the violence profiles

Each of the areas will be described by a set of characteristics that will make up the profile of the regions. $a_i C = \{c_1, \ldots, c_k, \ldots, c_l\}$

This profile can be obtained directly from the computational algorithms used to capture data from the regions, using the available statistics. $F_{a_j} = \{v_1^j, \ldots, v_k^j, \ldots v_l^j\}, j = 1, \ldots n$

The assessments of the characteristics of the Areas, a_j, will be expressed from the linguistic scale $Sv_k^j \in S$, where $S = \{s_1, \ldots, s_g\}$ is the set of linguistic terms defined to evaluate the characteristic of the SVN numbers. For this, the linguistic terms to be used are defined.

Once the set of areas represented by the alternatives has been described: $A = \{a_1, \ldots, a_j, \ldots, a_n\}$.

The profiles are saved in a database for later retrieval; this step constitutes the fundamental element on which the operation of the inference process is based. Basically, the database contains the different profiles historically measured in terms of criteria C, which makes it possible to compare some characteristics of the case under analysis with previous ones and thus proceed in a similar way.

This method has the advantage that an automatic, fast, effective and efficient search can be made of these archived cases, in a way that it constitutes a support system for the legislative decision. The basis for this is that the classification of a case on whether or not it is suspected to be a case of human trafficking is a complex problem, usually not that obvious. The database contains both cases involving human trafficking profiles and others trafficking crimes.

Evaluation and classification of alternatives

In this activity the information of the regions about their preferences is determined, being stored in a profile so that: $P_e = \{p_1^e, \ldots, p_k^e, \ldots, p_l^e\}$.

The profile will be made up of a set of attributes that characterize people: $C^e = \{c_1^e, \ldots, c_k^e, \ldots, c_l^e\}$ Where $c_k^e \in S$

This can be obtained by example or through the so-called conversational approach which can be adapted [33].

In this activity, the regions are filtered according to the stored profile to find which ones are the most suitable according to the present characteristics.

For this purpose, the similarity between the profile of the areas P_e and each available profile a_j registered in the database is calculated. To calculate the total similarity the following expression is used:

$$S_i = 1 - \left(\left(\frac{1}{3} \sum_{j=1}^{n} \left\{ \left(a_{ij} - a_j^* \right)^2 + \left(b_{ij} - b_j^* \right)^2 + \left(c_{ij} - c_j^* \right)^2 \right\} \right)^{\frac{1}{2}} \right) \tag{2}$$

The function calculates the similarity between the values of the attributes of the profile of the areas and those stored, Sa_j[34].

Generation of recommendations

Once the similarity between the profile of the regions and those stored in the database has been calculated, each of the profiles are ordered according to the obtained similarity represented by the following similarity vector, $D = (d_1, \dots, d_n)$

The process of generating recommendations expresses that the best recommendation will be those that best satisfy the needs of the profile of the regions, that is, that present the greatest similarity. Statistically, a lower similarity index is accepted, greater than or equal to $\alpha = 0.85$.

4 Implementation of the method to determine profiles of violence in people from regions of Ecuador

This section describes the implementation of the proposed method to determine profiles of violence in people from regions of Ecuador. The method allows the classification of the different geographical regions of Ecuador to facilitate decision-making in government analyzes.

For the application of the proposal, we start from the set of data stored in the database on the regions that allow the analysis of the information. Next, a demonstrative example is presented from which we start from the database that has:

$$A = \{a_1, a_2, a_3, a_4, a_5\}$$

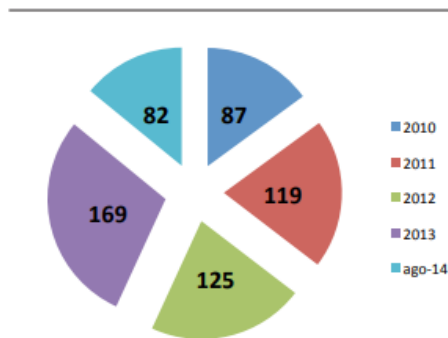Described by the attribute set

$$C = \{c_1, c_2, c_3, c_4, c_5\}$$

The attributes will be assessed on the following linguistic scale (Table 1). These evaluations will be stored to feed the database.

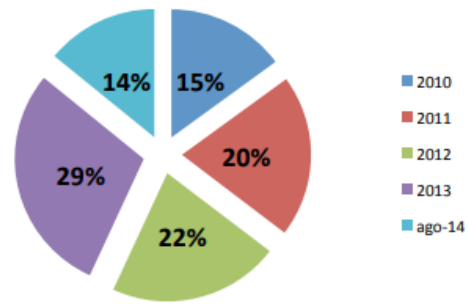| Linguistic term	SVN numbers
Extremely good (EG)	(1,0,0)
Very very good (VVG)	(0.9, 0.1, 0.1)
Very good (VG)	(0.8,0.15,0.20)
Good (G)	(0.70,0.25,0.30)
Moderately good (MDG)	(0.60,0.35,0.40)
Mediun (M)	(0.50,0.50,0.50)
Moderately bad (MDB)	(0.40,0.65,0.60)
Bad (B)	(0.30,0.75,0.70)
Very bad (VB)	(0.20,0.85,0.80)
Very very bad (VVB)	(0.10,0.90,0.90)
Extremely bad (EB)	(0,1,1)

Table 1. Linguistic terms used [35].

Figure 2 shows a graph of the behavior of the complaints made during the period between 2010 and 2014.

Graph 1: Human trafficking complaints 2010 - Aug 2014

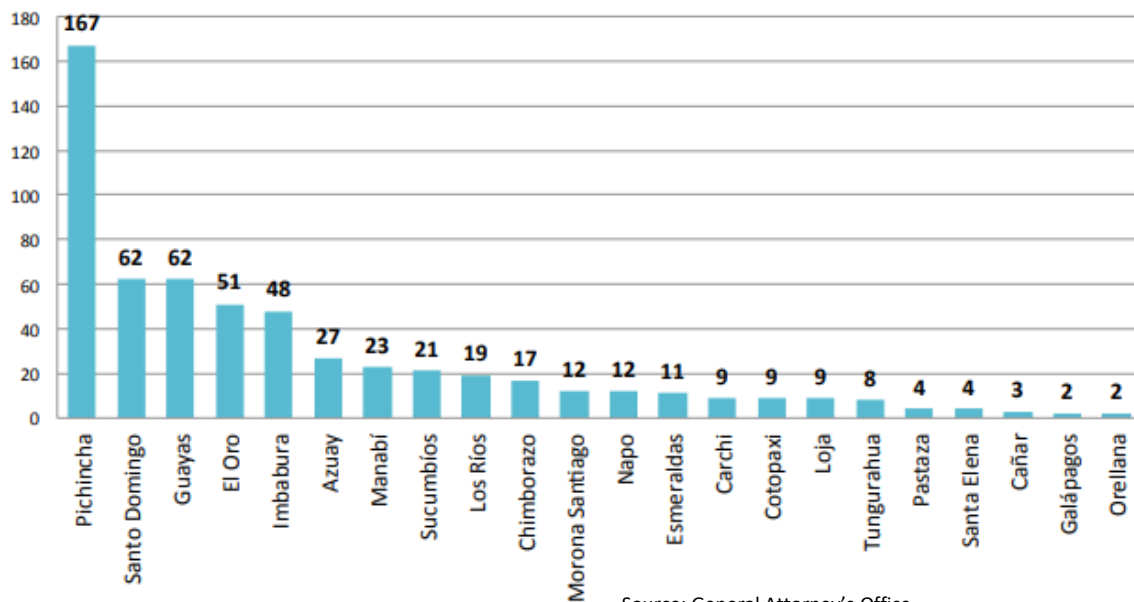**Graph 1: Human trafficking complaints 2010- Aug 2014 (%)**

Source: General Attorney's Office
Elaboration: Proyecto Fronteras, FLASCO Ecuador.

Figure 2: Behavior of complaints between 2010 and 2014

Figure 3 shows a breakdown of the information that illustrates the complaints of persons by province in the corresponding period between 2010 and 2014.

Provincial Human trafficking complaints (2010 - Aug 2014)

Source: General Attorney's Office
Elaboration: Proyecto Fronteras, FLASCO Ecuador.

Figure 3: Behavior of complaints by provinces between 2010 and 2014

From the data obtained, the analysis of the proposed case study is carried out. Table 2 shows a view with the data used in this example.

	c_1	c_2	c_3	c_4
a_1	G	G	VG	VG
a_2	G	VG	G	VG
a_3	G	VG	VG	G
a_4	VG	VG	G	G
a_5	G	VG	G	VG
a_6	VG	VG	G	G
a_7	G	VG	G	VG

a_8	VG	G	G	VG
a_9	VG	VG	G	G
a_{10}	G	VG	G	VG
a_{11}	VG	G	G	VG
a_{12}	VG	VG	G	G
a_{13}	G	VG	G	VG
a_{14}	VG	G	G	VG
a_{15}	VG	VG	G	G
a_{16}	G	G	VG	VG
a_{17}	G	G	VG	VG
a_{18}	G	VVG	B	B
a_{19}	G	G	EG	VG
a_{20}	G	G	EG	MDG
a_{21}	G	G	EG	MDG
a_{22}	EG	VVG	EG	MMG

Table 2: Regional profiles database.

The criteria that we propose to evaluate are the following, although in a specific region others could be included.

c1: There are technical, human, logistical, and anti-criminal means to detect in time and effectively eliminate any attempt of human trafficking in the region

c2: The police, political and citizen authorities, among others in the region, reject this type of crime and have no link with human trafficking, as well as being willing to contribute to its confrontation.

c3: The penalties stipulated for citizens who commit this type of crime are reliably applied within the region.

c4: There are multidisciplinary teams of specialists who effectively serve people who have been victims of human trafficking in the region.

If a region u_e wishes to receive the recommendations of the system, it must provide information expressed by the profiles of people. In this case:

$$P_e = \{B, EB, EB, MDB\}$$

The next step in our example is the calculation of the similarity between the regional profile and the profiles stored in the database.

Stored profile	Similarity
a_1	0.31290
a_2	0.31290
a_3	0.51129
a_4	0.31182
a_5	0.31290
a_6	0.31182
a_7	0.31290
a_8	0.11343
a_9	0.31182
a_{10}	0.31290
a_{11}	0.11343
a_{12}	0.31182
a_{13}	0.31290
a_{14}	0.11343
a_{15}	0.31182
a_{16}	0.31290
a_{17}	0.31290
a_{18}	0.30000
a_{19}	0.31569
a_{20}	0.68682
a_{21}	0.68682
a_{22}	0.31569

Table 3. Similarity between stored profiles and regional profile

In the recommendation phase, the profile that most closely matches the regional profile is evaluated. An ordering of the profiles based on this comparison would be the following.

$\{a_{20}, a_{21}, a_3\}$

In case the system recommends the two closest profiles, these would be the recommendations:

a_{20}, a_{21}.

Conclusions

The present work developed a method to determine profiles of human trafficking violence in regions of Ecuador. The method based its operation on a multi-criteria approach for the evaluation of regional profiles and implemented a knowledge-based recommendations system. It supports its processing by SVN numbers to express uncertainty with the use of linguistic terms.

The application of the proposed method allowed the identification of the regional profiles that most correspond to the group of characteristics of the regions that affect the type of violence that is modeled.

The regional profiles generated constituted the knowledge base that was stored in a database to feed the case base of the proposed method. It is recommended for future research to work on the inclusion of more complex aggregation models for generating recommendations.

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