A Study on Human Transiting Based on Big Data and Web Semantics: Distinguishment and Detection

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ABSTRACT

In the progress of globalization, the transnational human traffic is spreading globally. It damages national economy and social order as well as infringes on the basic human rights of the victims, which has aroused general concern all over the world, becoming global issues. One of the important features in human being traffic is the factor of globalization. A destination-source model works as a deterrent which is applied in the identification of smuggling and trafficking of illegal immigrants. The related results show that the employer penalty and market wage will influence the amount of smuggling and trafficking immigrants. Tax offered by legal unskilled workers at destination countries provides financial support for the inland monitoring of illegal immigrants. The improved SVM (supported vector machine) is proposed to study online textual data used for advertisement classification, with the purpose of discerning underlying human trafficking patterns on the network and recognizing suspicious advertisements, a concern of law-enforcement agencies.

KEYWORDS

Big Data·Decision Analysis, Human Trafficking, Optimization Model, Support Vector Machines

INTRODUCTION

The proverb, “no trading, no killing,” indicates that an individual’s suffering comes from the needs and greed of others. What happens if the illegal trading happens to humans? In February 2017, the American administration reasserted its commitment to address human trafficking or the “employment, harboring, transportation, provision, or acquisition of any labor or service by violence, fraudulence, or suppression that facilitates submission to unwilling servitude, peonage, debt bondage, and slavery” (Rothman et al., 2017, p. 1046). In such cases, victims lose their freedoms through violence and fraudulence. Unfortunately, this historical problem is becoming more serious.

Historical Issues on Human Trafficking

Historical textbooks refer to slavery, or human trafficking, as “Black cargoes.” Slavery was a commonplace problem in history, specifically in Africa (Mannix, 1962; Silva, 2016). Slavery and coercive labor existed in many kingdoms and communities across Africa for thousands
of years, setting the stage for the Arab and Atlantic slave trade. At that time, there was no accurate data to support slavery or its associated political and economic systems. The Atlantic slave trade involved the transportation of African people. From the 16th to 19th centuries, many people were sent from Africa to America through a triangular trade route and middle passage (Routledge, 2017; Shea 2016). Regrettably, the tragedy of this initial form of human trafficking continues today.

Related Issues in Contemporary Society

Human suffering continues in the modern age. The effects of the Iraq war (2003-2011) have not faded. In fact, the rise of the Islamic terrorist organization, Islamic State (IS), has caused global panic. Protests of the Syrian War have disrupted international order since March 2011. Moreover, the new era of civil wars has produced a significant number of refugees (people who are compelled to cross national borders and are unable to return to their homeland), which has created a refugee crisis throughout Europe. In addition, media in countries like France and Germany have shown a strong pessimism for many of these displaced (Ignatieff et al., 2016; Lischer, 2015; Wirth, 2016).

Smuggling refers to the illegal transportation or carrying of imported and exported gold, silver, foreign currency, goods, and people. Although not an emerging phenomenon, it has attracted increased international attention. Greece, due to its geographical location and political status, is one example of a location with increased attention (Carrera & Guild, 2016; Sanchez, 2017).

Events related to the smuggling of migrants are causing changes across the globe. These are manifested in migrations from east to west and south to north. There is no denying that the United States is a country known for immigration, particularly along its border with Mexico. Although illegal immigration occurs, it is prohibited by American law. Interestingly, most of the illegal immigrants can acquire U.S. citizenship (Buenavista, 2016; Mayda & Peri, 2017; Payan, 2016; Terrio, 2015).

The sex industry is also a controversial (and often restricted) phenomenon. In many countries, sex trade leads to prostitution or forced prostitution. An in-depth survey of relevant practitioners reveals that these women are often involved in more issues, including trafficking, domestic violence, family discord, social unrest, and social justice (Schaffner et al., 2016; Webb, 2017). Conversely, the adult video industry in Japan may bring Spring to those adults in need (Wong, 2017; Zhang, 2017).

Influence of Globalization on Illegal Trade

After World War II, human trafficking extended to women and children around the world (see Figure 1). Transnational trafficking can refer to crimes related to the recruitment of domestic helpers, adoption of children, and organization of workers. Women and children, after being trafficked by organized criminal gangs, may be sent to destinations with poor living conditions. Some are forced to work as family service providers. Children are enslaved to earn profits for criminals (Rijken & Pijnenburg, 2016; Van Dijk & Van der Heijden, 2016).

Opportunities for cross-border human trafficking have increased due to international economic exchanges, the rapid development of transportation and communication, frequent contacts between people from all countries, and economic differences among countries due to globalization (Danailova-Trainor & Belser, 2016; Williamson, 2017). On the one hand, globalization is the main driver of international labor migration. On the other hand, migrants can become the victims of illicit traffic in large-scale population movements.

With the growth of the Internet, lives and private information are exposed online. In addition, many Websites specialize in illegal transactions related to pornography, adult videos, and human trafficking. People can search online, without geographical restrictions, for sellers or buyers. While
the Internet creates convenience, it also breeds criminal activity. This article will analyze demography-related conclusions by making use of statistical data on the Internet.

**Risk of Human Trafficking**

Human trafficking poses a threat to social stability. It is more likely to occur in underdeveloped areas. Human trafficking may also result in the breakdown of family structures. The physical and mental health of trafficked individuals will be affected due to lack of freedoms and opportunities (Ottisova et al., 2016). Human trafficking is inhumane; therefore, relevant stakeholders must be punished.

**Work on the Human Trafficker**

Trafficked persons are often vulnerable to deception, especially in the absence of financial support or in a deteriorating external environment. Most of these individuals are ordinary people. However, the fate of the poor is sold as a commodity. These individuals may have little hope, fewer opportunities, little to no freedom, or a life without happiness.

It is necessary to carry out a limited analysis of prior cases and related data to draw useful conclusions that guide investigations of criminal activities and the location and compensation of victims.

Human trafficking can change over time. Effective measures must be taken to curb this global trend. It is necessary to study human trafficking trends in the contemporary era, such as how to find trafficked people and how to distinguish trafficked people from normal people. Finding human trafficking-related Websites in the chaotic online world is a pressing concern.

The Neumann-Morgenstern function will be used to compare smuggling and trafficking among illegal immigrants. The data analysis of machine learning-based human trafficking activities will also be performed. Exogenous information in the feature space of unlabeled data is mined by introducing a regularization term. Correlation models are trained based on this method.
DESCRIPTION OF THE PROBLEM

Global Overview of Human Trafficking

No country is immune to human trafficking; therefore, its victims can be found across the world. Over 500 diverse trafficking flows were detected from 2012 to 2019 (the latest data has not been released). Stereotypes often associate women with human trafficking (abductions and forced prostitution). According to studies, the number of trafficked men has been on the rise, although men are less likely to be coerced into sexual services. In the last decade, children accounted for 28% of detected victims. Men accounted for 21% of detected victims (see Figure 2). Criminal justice practitioners now pay more attention to the diversity of offenders, victims, exploitation patterns, and flows of human trafficking (Kar & Beladi, 2017; Kempadoo et al., 2015; Shelley & Lee, 2007; Smuggling & Center, 2008).

Victims and traffickers often share the same backgrounds, especially ethnicity and language. Admittedly, it is much easier for traffickers to defraud the trust of ordinary victims in such circumstances.

Trafficked persons are often involved in prostitution, begging, sex trade, forced labor, organ transplant, and compulsory marriage (see Figure 3).

Figure 2. Trends in the number of men among detected human trafficking victims
It is important to note the following:

- Women dominate human smuggling efforts in 30% of countries. In Eastern Europe and Central Asia, more than 60% of human smuggling is committed by women.
- Seventy-nine percent of human trafficking cases are for the sex trade industry; 18% of the cases are for forced labor. Forced labor may, in fact, be a higher percentage, but forced coercion is extremely covert.
- Trafficking of children accounts for more than 20% of the population transactions, especially in Africa and southeast Asia.
- The conviction rate for human trafficking is low.
- People in densely populated and impoverished areas are highly vulnerable to trafficking.
- It is almost impossible to trace the “ultimate exploiter” or behind-the-scenes owner of the trafficking organization.

To some extent, cross-border trafficking is associated with normal migration flows. Wartime refugees and persecuted victims are easy targets for traffickers. Conflicts create favorable conditions as wartime refugees flee persecution. The large number of armed forces stimulates the requirement for labor and sexual services, especially those with backward laws and institutions. Consequently, militant groups enlist or kidnap children as combatants, which can be seen across villages, cities, and refugee camps. There are thousands of victims in countless battles, especially in sub-Saharan Africa and the Middle East. In addition, women are recruited as sex slaves.
Illegal Immigration

Illegal immigrants may induce the unemployment of legal unskilled workers. Companies found to have employed illegal workers face fines. Workers with smuggling and trafficking backgrounds are also considered illegal workers. Hence, smugglers can be seen as a link between potential illegal immigrants and local employers. Border apprehension probability of $\lambda_m < 1$ is used to estimate illegal immigration. The likelihood of inland detection with probability of $\lambda_e < 1$ is used to estimate illegal workers. For law practitioners, the defined objective function considers the tax paid for prohibiting illegal entry and receipt of unemployment benefit. The government aims to reduce illegal immigration through a balanced budget approach, including inland apprehension cost and allotment of unemployment benefit.

Generally speaking, $\lambda_m$ is stable and $\lambda_e$ is selected. The trafficker hires the illegal worker and charges rent. If traffickers are not competent, they behave like smugglers. Figure 4 shows the expected payoff extracted by the migrant, agent, and local employer.

Local and Overall Optimization of Human Trafficking Detection

Paradoxically, there is a lot of online data but little potential information. The key is to infer the correlation between data based on known information, obtain unknown information based on known information, get changing trends based on existing data, and detect human trafficking based on relevant data, which has important practical value.

Diverse group features represent typical human trafficking behaviors. With these features, activities that do not have the basic characteristics are eliminated. In addition, the classic SVM algorithm is improved; the relevant data are analyzed. In the convex optimization expression of Laplacian SVM, the additional feature space information is utilized as a numerical regularization term. The underlying data geometry can be used as an inherent regularization component. Model training is conducted on labeled and unlabeled data to detect human trafficking-related ads. It is sent to experts for validation (Alvari et al., 2017; Criminisi et al., 2012; Kalal et al., 2012).

MODELS DESCRIPTION

Model of Distinguishing Smuggling and Trafficking

Legal unskilled workers will pay a tax and receive unemployment benefit $\mathcal{I}$ as a part of $w$ when they lose their jobs. The Neumann-Morgenstern utility function is $\mathcal{R} = \mathcal{R} - (\mathcal{R} - e^{-W})$, $\mathcal{R} > 0$, where $\mathcal{R}$ means income. The probability is defined as

Figure 4. Expected payoff extracted by the migrant, agent, and local employer
\[ \lambda^E \left\{ \lambda^E = \lambda^E(t) \right\}, \text{with} \lambda^E_1 > 0, \lambda^E_2 \geq 0 \]. Hence, indirect expected compensation for unskilled workers can be modeled as:

\[
\max E(\Re) = \lambda^E \left( -e^{-w(1-\ell)} \right) + \left( 1 - \lambda^E \right) \left( -e^{-w(3-\ell)} \right) \quad (1)
\]

Equation 1 shows how the tax rate maximizes expected income. If \( \Im \) is given, \( E(\Re) \) is only related to time \( t \). Given \( \lambda^E = (t)^{0.5}, w = 1, \) and \( \Im = 0.5 \), the maximum value occurs at time of 0.05 (see Figure 5).

Furthermore, the first-order differential equation 1 can be given as:

\[
\frac{d}{dt} \left( E(\Re) \right) = 0 \Leftrightarrow -\left( \lambda^E - \lambda^E \right) \left( e^{-w(1-\ell)} - e^{-w(3-\ell)} \right) + e^{-w(3-\ell)} = 0 \quad (w = 1) \quad (2)
\]

Thus, the optimal value can be expressed as:

\[
t^* = -\frac{1}{2} \left[ 1 + \frac{1 + 4e^{-1+3} - 2e^{-2(1-3)}}{2 \left( e^{-1+3} - 1 \right)^2} \right] \quad (3)
\]

These equations give general expressions for optimal taxation, penalty, and illegal income.

If all people engaged in smuggling and trafficking share the same legal entry rights, the placement cost for illegal immigrants is \( C > 0 \). If the migrant pays a fee \( h \), \( (h - C) \) will be received with a
probability of \( (1 - \lambda_m) \). The government receives \( (t^* + p_E - \ell) \) when it captures employers, which is a probabilistic event. Otherwise, \( (t^* - \Xi - \ell) \) can be derived. Therefore, it happens with a probability of \( (1 - \lambda_E) \). Thus, the following equation can help the government balance the weights:

\[
B = \lambda_E (t^* + p_E - \ell) + (1 - \lambda_E) (t^* - \Xi - \ell) = 0
\]

(4)

Hence:

\[
P_E^* = \frac{(\ell - t^*)}{\lambda_E (t^*)} + \frac{1 - \lambda_E (t^*)}{\lambda_E (t^*) \Xi}
\]

(5)

From equation 5, we can obtain:

\[
\frac{d}{d\Xi} P_E^* = -\frac{\frac{dt^*}{d\Xi} - (1 - \lambda_E (t^*)) + (\ell - t^* + \Xi) \frac{d\lambda_E}{d\Xi}}{(\lambda_E (t^*))^2} > 0
\]

(6)

\[
\frac{d\lambda_E}{d\Xi} = \frac{d\lambda_E}{dt^*} \frac{dt^*}{d\Xi}
\]

\[
\frac{d\lambda_E}{dt^*} > 0
\]

and:

\[
\frac{dt^*}{d\Xi} < 0
\]

\( P_E^* \) will be influenced by value \( \Xi \) to balance the government’s budget.

When considering commission \( \alpha \) paid by smugglers from local employers for smuggled migrant workers, the profit can be modeled as:

\[
E(\pi)_{LE} = (1 - \lambda_E) (1 - \alpha) (1 - w_I) + \lambda_E (-p_E) = 0
\]

(7)

where \( (1 - \alpha) (1 - w_I) \) shows the profit earned by the employer after deducting the commission \( \alpha \) for the smuggler and \( w_I \) for the illegal worker. \( (1 - w_I) \) suggests the gap of legal and illegal income. By substituting \( P_E^* \) into the formulation of \( E(\pi)_{LE} \), it can be obtained as:
\[ w^* = 1 - \frac{\lambda_E p_E^*}{(1 - \alpha)(1 - \lambda_E)} \]  
(8)

The differential equation of the above equation can be expressed as:

\[
\frac{d}{d\lambda} w^* = -\frac{1}{1 - \alpha} \left( \frac{d\lambda_E}{d\lambda} p_E^* + \frac{\lambda_E}{(1 - \lambda_E)} dp_E^* \right) \tag{9}
\]

It can be seen from equation that the increase of \( \mathcal{I} \) leads to the increase of \( p_E^* \) and the decline of \( w^* \).

The traffickers (or T) will also pay the penalty \( p_E^* \) with local employers. Thus, they are more similar in this view. They obtain expected rent \( E(\pi)_T \) from hiring illegal workers, which includes a fraction of \( w^*_j \) as the rent. The cost is \( C \) for failed entry. If they are arrested in an inland investigation, there will be penalties. Therefore, it can be obtained as:

\[
E(\pi)_T = \left(1 - \lambda_m \right) \left( h - C + (1 - \lambda_E) \left( -w^*_j + kw^*_j + w \right) + \lambda_E \left( -p_E^* \right) \right) + \lambda_m \left( -C \right) \tag{10}
\]

where \( E'(\pi)_T > 0, E''(\pi)_T = 0 \). The expected profit of the smuggler (or S) is:

\[
E(\pi)_S = \left(1 - \lambda_m \right) \left( h - C + \alpha \left(-w^*_j + w \right) \right) + \lambda_m \left( -C \right) \tag{11}
\]

\[
E(\pi)_S < E(\pi)_T \text{ can be obtained under the condition of:}
\]

\[
(1 - \lambda_E) \left( -w^*_j + kw^*_j + w \right) + \lambda_E \left( -p_E^* \right) > \alpha \left(-w^*_j + w \right) \tag{12}
\]

Equation 12 can be transformed as the following formulation under the condition of \( w = 1 \):

\[
\left(1 - \lambda_E \right) \left(-w^*_j + 1 \right) + \lambda_E \left(-p_E^* \right) > \alpha \left(1 - \lambda_E \right) \left(-w^*_j + 1 \right)
\Rightarrow \left(1 - \lambda_E \right) \left(-w^*_j + kw^*_j + w \right) + \lambda_E \left(-p_E^* \right) = \left(1 - \lambda_E \right) \left(kw^*_j \right) + \alpha \left(1 - \lambda_E \right) \left(-w^*_j + 1 \right) \tag{13}
\]

Combining equation 11 and equation 13, the following can be obtained:

\[
(1 - \lambda_E) kw^*_j + \alpha \left(1 - \lambda_E \right) \left(1 - w^*_j \right) > \alpha \left(-w^*_j + 1 \right) \tag{14}
\]

Thus, the optimal solution can be obtained:
\[ k^* = \alpha \left(1 - w^*_i\right) \frac{\lambda_E}{w^*_i - 1 - \lambda_E} \quad (15) \]

The results:
\[
\frac{dk^*}{d3} < 0, \text{ if } \lambda^*_E t^{*} \approx 0
\]

show that the proportion of traffickers under sufficient condition will increase with the unemployment benefit rate in the host country.

Another important issue is the source country problem. The corresponding numerical model can be expressed as:
\[
E\left(\kappa^*_m\right) = k\left(1 - \lambda_m\right)\left(1 - \lambda_E\right) w^*_i + \lambda_E \left(-h\right) + \lambda_m 0 \quad (16)
\]

Finally, the desired income of an immigrant compared with a trafficker is:
\[
E\left(\kappa^*_m\right) = (1 - k^*) (1 - \lambda_m) \left(1 - \lambda_E\right) \frac{w^*_i}{2} (1 - k^*) + \lambda_E \left(-h\right) \quad (17)
\]

**Improved SVM-Based Supervision for Detecting Human Trafficking**

This section expounds on the six groups of features that indicate evident human trafficking activities on public platform Websites. The mathematical model can express different features:

1. Advertisement language pattern
2. Countries of interest
3. Words and phrases of interest
4. Advertised victims
5. Weight of victims
6. Referential Websites

A complicated post will be made to avoid confusion. Furthermore, a complexity theory is adopted, namely the Kolmogorov complexity theory, which can discern the size of the shortest program that replicates a string of characters on the universal machine. Assuming that E is the content and \( \varepsilon_i \) is the given word in E, the corresponding complexity of E is listed as:
\[
K(E) \approx -\sum_{i=1}^{n} P(\varepsilon_i) \log_2 P(\varepsilon_i) \quad (18)
\]

Corresponding words like “sweet, fresh, and new to game” are indirectly introduced to children. This may also be the case in countries like Japan, Korea, Vietnam, and the U.S. Posters usually include links that criminals will want others to enter.
Thus, it is necessary to construct a feature vector that corresponds to the important features of human trafficking. Additionally, a filtered dataset must be built, including raw data (20822), filtered data (3543), unlabeled data (3343), positive labeled data (70), and negative labeled data (130). The improved SVM is utilized for the dataset and data analysis.

The basic optimization problem can be listed as:

\[
\min \zeta \left\| g_\theta \right\|^2 + C_1 \sum_{i=1}^{l} H_i \left( y_i g_\theta (\varepsilon_i) \right)
\]

where \( g_\theta \) suggests the decision function in which \( g_\theta = w\Omega + b \) and \( \Omega \) denotes the feature map. As the classical Representer theorem suggests, the solution for the optimization problem exists in the Hilbert space \( \mathcal{H}_\kappa \):

\[
g^* = \sum_{i=1}^{l} \alpha_i^* K(\varepsilon_i, \varepsilon_i)
\]

where \( K \) means the \( l \times l \) Gram matrix for the labeled samples above. Accordingly, the corresponding problem is transformed into:

\[
\begin{align*}
\min & \frac{1}{2} \left\| w \right\|^2 + C_1 \sum_{i=1}^{l} \xi_i \\
\text{s.t.} & \\
y_i (w\Omega(\varepsilon_i) + b) & \geq 1 - \xi_i, \quad i = 1, 2, \ldots, l \\
\xi_i & \geq 0, \quad i = 1, 2, \ldots, l
\end{align*}
\]

(21)

When considering the algorithm again, it is better to use unlabeled cases for hypothesis reconstruction during the learning process. Then, a regularization term is introduced into the standard equation to solve for the optimization term as follows:

\[
\min \frac{1}{2} \sum_{i=1}^{l} F_{ij} \left\| g_\theta (\varepsilon_i) - g_\theta (\varepsilon_j) \right\|^2 = f_p^T L f_p
\]

(22)

where:

\[
F_{ij} = \frac{1}{n_j} \left( \Omega(\varepsilon_i) \Omega(\varepsilon_j) \right)
\]

and:

\[
f = \left[ f(\varepsilon_1), \ldots, f(\varepsilon_{i+u}) \right]^T
\]

By introducing a regularization term and an inherent smoothness penalty term, the standard equation solution is optimized as follows:
\[
\min \| g_i \|_k^l + C_i \sum_{i=1}^l H_i \left( y_i g_o \left( \varepsilon_i \right) \right) + C_i g_o^T L g_o + C_i g_o^T L g_o 
\]  
(23)

The solution in \( H_k \) is:

\[
g^*_o \left( x \right) = \sum_{i=1}^{l+u} \alpha^*_i K \left( \varepsilon_i, \varepsilon_i \right) 
\]  
(24)

where \( K \) represents the \((l + u) \times (l + u)\) Gram matrix for overall samples:

\[
\min \frac{1}{2} \alpha^T K \alpha + C_i \sum_{i=1}^l \xi_i + \frac{C_i}{2} \alpha^T K L K \alpha + \frac{\gamma l}{2(l + u)^2} \alpha^T K L K \alpha 
\]

s.t.

\[
y_i \left( \sum_{j=1}^l \alpha_j K \left( \varepsilon_i, \varepsilon_j \right) + b \right) \geq 1 - \xi_i, i = 1, 2, ..., l \\
\xi_i \geq 0, i = 1, 2, ..., l
\]  
(25)

Through the introduction of relevant Lagrangian multiplier \( \beta \) and \( \gamma \), the corresponding equation is defined as:

\[
L = \frac{1}{2} \alpha^T K \left( I + C_r L + \frac{\gamma l}{(l + u)^2} L' \right) \alpha + C_i \sum_{i=1}^l \xi_i - \\
\sum_{i=1}^l \beta_i \left( y_i \left( \sum_{j=1}^{l+u} \alpha_j K \left( \varepsilon_i, \varepsilon_j \right) + b \right) - 1 - \xi_i \right) - \sum_{i=1}^l \gamma_l \xi_i 
\]  
(26)

Hence, the differential equation can be obtained as:

\[
\frac{\partial L}{\partial b} = 0; \quad \frac{\partial L}{\partial \xi_i} = 0
\]

Then, the reduced equation can be derived as:

\[
L^R \left( \alpha, \beta \right) = \frac{1}{2} \alpha^T K \left( I + C_r L + \frac{\gamma l}{(l + u)^2} L' \right) \alpha \\
- \sum_{i=1}^l \beta_i \left( y_i \left( \sum_{i=1}^{l+u} \alpha_j K \left( \varepsilon_i, \varepsilon_j \right) + b \right) - 1 - \xi_i \right) - \sum_{i=1}^l \gamma_l \xi_i 
\]  
(27)
Besides, the following equation can be derived by setting \( \frac{\partial L^R(\alpha, \beta)}{\partial \alpha} = 0 \):

\[
K \left( I + C_r L + \frac{\gamma}{(l + u)^2} L' \right) \alpha - K J^T Y \beta = 0
\]  
(28)

Accordingly, the optimal solution \( \alpha^* \) can be obtained by solving the following equation:

\[
\alpha^* = \left( I + C_r L + \frac{\gamma}{(l + u)^2} L' \right)^{-1} J^T Y \beta
\]
(29)

Then, the dual issue of QP (quadratic programming) can be addressed by substituting \( \alpha \) back in the reduced equation:

\[
\beta^* = \text{arg max}_{\beta \in \mathcal{R}} \left\{ -\frac{1}{2} \beta^T Q \beta + \sum_{i=1}^{l} \beta_i \right\}
\]

\[
s.t.
\]

\[
\sum_{i=1}^{l} \beta_i y_i = 0
\]

\[
0 \leq \beta_i \leq C_i
\]
(30)

where \( \beta = [\beta_1, \ldots, \beta_l]^T \). The derived solution is:

\[
Q = Y J K \left( I + \frac{\gamma}{(l + u)^2} L' \right) K^{-1} J^T K
\]
(31)

In the above algorithm, the penalty parameter is \( C_r = 0.6 \). The relevant regularization parameters include \( C_r = 0.2 \) and \( C_s = 0.2 \). Linear kernel was adopted by this method. A more comprehensive conclusion is drawn by comparing the approaches in this case. The test results are shown in Tables 1, 2, and 3.

As can be seen in Figures 6 and 7, existing data extracted from online escort advertisements can be used to combat human trafficking. Therefore, it is necessary to determine whether there is hidden human trafficking information in escort advertisements. The filtering method is proposed in this article. The trained model is utilized to identify labels for unknown data. According to the corresponding findings, the effectiveness of the proposed method is demonstrated.

**CONCLUSION**

By recalling the announcement released by the United Nations Office on Drugs and Crime (UNODC), the standard labor policy for unskilled workers intends to figure out a means to differentiate the
### Table 1. AUC and accuracy result with different solutions

| Learner    | AUC | Accuracy |
|------------|-----|----------|
|            | \( F_1 \) | \( F_2 \) | \( (F_1, F_2) \) | \( F_1 \) | \( F_2 \) | \( (F_1, F_2) \) |
| Improved SVM | 0.92 | 0.92 | 0.97 | 0.92 | 0.92 | 0.98 |
| SVM         | 0.9  | 0.9  | 0.9  | 0.91 | 0.9  | 0.92 |
| RBF         | 0.84 | 0.94 | 0.93 | 0.85 | 0.92 | 0.93 |
| KNN         | 0.78 | 0.91 | 0.85 | 0.86 | 0.93 | 0.94 |

### Table 2. Precision, recall, and F1-score for positive class and negative class with different solutions

|          | Precision | Recall | F1-score |
|----------|------------|--------|----------|
|          | class\( _p \) | \( p \) | class\( _n \) | \( n \) | class\( _p \) | \( p \) | class\( _n \) | \( n \) |     |
| Improved SVM | 0.92 | 0.92 | 0.92 | 0.92 | 0.91 | 0.91 | 0.92 |
| SVM       | 0.9  | 0.9  | 0.91 | 0.9  | 0.93 | 0.93 | 0.93 |
| RBF       | 0.84 | 0.94 | 0.85 | 0.92 | 0.80 | 0.80 | 0.74 |
| KNN       | 0.78 | 0.91 | 0.86 | 0.93 | 0.88 | 0.88 | 0.93 |

### Table 3. Precision, recall, and F1-score for positive class and negative class using \( F_1 \)

|          | Precision | Recall | F1-score |
|----------|------------|--------|----------|
|          | class\( _p \) | \( p \) | class\( _n \) | \( n \) | class\( _p \) | \( p \) | class\( _n \) | \( n \) |     |
| Improved SVM | 0.97 | 0.97 | 0.95 | 0.95 | 0.94 | 0.94 | 0.95 |
| SVM       | 0.93 | 0.93 | 0.95 | 0.93 | 0.93 | 0.93 | 0.94 |
| RBF       | 0.94 | 0.84 | 0.85 | 0.92 | 0.80 | 0.80 | 0.74 |
| KNN       | 0.78 | 0.91 | 0.86 | 0.93 | 0.88 | 0.88 | 0.93 |

### Figure 6. Effect of different parameters on performance
economic effect of smugglers and traffickers on both legal and illegal workers. The findings suggest that if taxes on legal unskilled workers are used solely for inland surveillance and unemployment benefits, there will soon be consequences while illegal immigration still exists. First, increasing unemployment benefit will aggravate the penalty for the recruitment of illegal workers. Second, it lowers the critical level of income and rent extraction for illegal workers. As a result, it is likely that more traffickers and illegal workers will be deterred from reaching their destinations.

Simply put, it has been successfully demonstrated that illegal immigration can be solved by standard labor market policy at the destination. Instead of claiming that this is the sole solution, it proves the interplay between unemployment benefits, employer penalties, wages for illegal workers in the labor market, and the payoff of smugglers and traffickers. Ultimately, the decision-making issue for underlying immigrants can be addressed with the same objective function. Other feasible solutions include amnesty for immigrants, invitation of skilled workers to combat against illegal immigrants, and problems of equal importance.

Existing data extracted from online advertising can be utilized to crack down on human trafficking. Online advertisements help to locate traces of human trafficking activities. The improved SVM algorithm is presented for further analysis on crawled data. The trained model is utilized for label recognition on unseen data. Results indicate that the method can effectively detect hidden human trafficking advertisements.

Furthermore, globalization is an important feature of human trafficking. The following measures are necessary to strengthen international law enforcement cooperation to curb the crime of human trafficking:

- Countries need to establish an effective cooperation mechanism.
- Countries should strengthen their cooperation in legal system construction.
- There is a need to strengthen cooperation in the training of law enforcement officials.

**FUTURE WORK**

**Future Work on Basic Issues of Human Trafficking**

Cross-border human trafficking has evolved into a severe crisis that threatens international societies in contemporary times. As an issue of international concern, cross-border human trafficking encroaches on
human rights and generates enormous implications. Countries have taken stern measures to launch laws that crack down on crime (Bayraktar, 2020; Jelokhani et al., 2020; Shamsafar & Ebrahimnezhad, 2021).

In a market economy, people who are desperate for wanton greed will take risks to exploit human beings as commodities to make huge profits. Measures must be taken to combat the long-term, arduous, complicated, and extensive struggle of transnational human trafficking. There are difficulties in establishing a state-by-state effort; therefore, it is increasingly urgent to establish various forms of transnational judicial cooperation. Through transnational cooperation, joint and vigorous measures can be taken to break down judicial barriers and provide countermeasures to combat transnational human trafficking.

**Future Work on the Modeling and Calculation Methods of Human Trafficking**

Mathematical modeling of trafficking problems is uncommon. Practical mathematical models are rare. Therefore, there is an urgent need to model fundamental issues related to human trafficking and explore the interrelationships between factors. It is vital to identify basic laws related to this illegal industry.

There is a significant amount of online data and illegal Websites related to human trafficking. More in-depth mathematical algorithms are needed to extract useful and invisible data and conclusions.
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