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ELECTRONIC MONITORING DEVICES AND DATA PROCESSING

ELEKTRONSKI UREĐAJI ZA PRAĆENJE I OBRADU PODATAKA

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Abstract:
Criminal justice authorities may sometimes wish to control or monitor the location of an individual without resorting to imprisonment. As a condition of bail, bond, sentencing, or probation, the judge may order the convicted person to wear an electronic monitoring device, or ankle monitor. An electronic monitoring device allows pretrial services, probation, or parole the chance to closely supervise the convicted person by keeping track of where person is, or in some cases, determine if the convicted person is consuming some prohibited substances such as alcohol or narcotics. Some systems provide tracing within the predefined restricted areas. Such systems are used in different situations, before a criminal trial or after conviction. The authors described different ankle monitor systems in use, their advantages and disadvantages and data collected in such manner. Some data from electronic monitoring device are important for each convicted person. The authors describe machine learning method, which can rely on data to predict whether the convicted person will repeat the criminal offense or not. This method uses the hypothesis and gradient descent. At the end, the authors explore the role of these devices by the law enforcement sanctions and measures outside the prison.

Key words:
ankle monitor, house arrest, machine learning, prediction, GPS monitoring device.

Apstrakt:
Krivični-pravosudni organi mogu ponekad želeti da kontrolišu ili prate lokaciju pojedinca bez pribegavanja zatvorskoj kazni. Kao uslov za kauciju, jemstvo, izricanje kazne ili uslovnu kaznu, sudija može zahtevati od osuđenog lica da nosi elektronski uređaj za praćenje ili oglicu za praćenje koja se nosi oko članka (tzv. nanogica). Elektronski uređaj za praćenje može se koristi pre sudskog postupka, ili tokom trajanja uslovne kazne kako bi se pomno pratilo kretanje osuđenog, njegova lokacija u određenom trenutku, kao i da li konzumira neke zabranjene supstance poput alkohola ili psihoaktivnih supstanci. Pojedini sistemi omogućavaju praćenje u definisanom ograničenom prostoru. Takvi sistemi koriste se u različitim situacijama, pre krivičnog postupka ili nakon izricanja presude. Autori opisuju različite sisteme za praćenje, njihove prednosti i nedostatke, kao i podatke koji se preko njih prikupljaju. Za svako osuđeno lice, određeni podaci iz elektronskog uređaja za praćenje su važni. Autori opisuju metodu mašinskog učenja, koja može predvideti na osnovu dobijenih podataka da li će osuđeni ponoviti krivično delo ili ne. Ovakva metoda oslanja se na hipotezu i opadajući gradijent. Na kraju rada, autori ispituju ulogu ovakvih uređaja za praćenje kao mera za sprovođenje zakona izvan zatvorskih okvira.

Ključne reči:
uređaj za praćenje osuđenog (tzv. nanogica), kućni pritvor, mašinsko učenje, predviđanje, GPS uređaj za praćenje.

1. INTRODUCTION

Every year a large number of convicted criminals are sent to prison. Given that prisons are expensive to build and run, and often involve cruel treatment of fellow citizens, possibly contributing to the conversion of inmates into 'hardened' criminals; it is not surprising that alternatives to imprisonment have been tried out. One of the more intriguing experiments in this area is the substitution of incarceration for electronic monitoring (Rafael & Ernesto, 2013). In an increasingly mobile world, house arrest ankle bracelets have numerous practical purposes. They're most commonly used to monitor the movements and behavior of repeat drug and impaired-driving offenders serving active sentences of probation. In many jurisdictions, they represent a partial solution to the perennial problem of overcrowded prisons. Most states offer convicts the option to wear an ankle bracelet during a period of supervised probation in lieu of spending time in prison.

The history of electronic monitoring dates from the 1960s. Home confinement is a representation of the fourth phase in the development of the European-North American correctional policy (Lilly & Ball, 1987). This fourth phase reflects the use of technology, electronics and computerized means to monitor and supervise offenders. It is the home detention of juveniles with intensive supervision and electronic monitoring. If we look at the historical order, dr Ralph K. Schwitzebel could be considered the father of electronic monitoring. He first discussed the idea of using electronic monitoring devices to track the locations of probationers and parolees in the community in the 1960s (Schmidt & Curtis, 1987). In 1964, he developed one-kilogram Radio Telemetry Device that could be worn by a person. The device transmitted signals to a modified missile-tracking unit up to 400 meters away, which determined the wearer's location on a screen. In the early 1980s, an American judge, supposedly inspired by a Spiderman comic, persuaded a company to develop a monitoring bracelet suitable for offend-

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ers to wear (Matt & Russell, 2003). In 1983, the first order was made requiring an offender who had breached parole to wear an anklet to monitor his future behavior (Liverani, 1998). This use of electronic monitoring devices became commonly known as “tagging”. The outcome was an electronic bracelet approximately the size of a pack of cigarettes that emitted an electronic signal picked up by a receiver placed in a home telephone. The early devices, however, were primitive and many individuals extricated themselves from the devices. The equipment for electronic home confinement has become very sophisticated over the last few years. Today, it is possible to have the equipment that will transmit a photo of the client, do an alcohol screening, or has a voice identifier to make sure the person is at home when checked. With these assurances built into the equipment, it is possible to achieve greater reliability of proper identification of the individual answering the call. There are still problems with electronic home detention, but these come from expecting the equipment to perform miracles instead of being used in conjunction with other methods of home confinement.

The key problem with electronic monitoring is how to prevent the convicted person from repeating criminal acts. Such a system should provide 24-hour monitoring. There is a great number of persons convicted for different criminal acts, which are in the electronic monitoring system. One probation officer has much more convicted citizen in his jurisdiction. That is a very large number of people for one person. Some of them will repeat the criminal offense, that’s for sure. The job of officers and employee in control centers is to predict which of the electronic monitoring convicted citizens could repeat the same offense. In order to prevent that, they must predict the convicted future behavior based on all collected data from electronic monitoring systems. For this purpose, authors proposed machine learning algorithms. These algorithms based on learning set of data, and the current set of data for monitoring offenders, could predict whether the offenders will repeat criminal offence or not.

The paper is organized as follows. The second section represents the description of electronic monitoring systems. The third section represents the types of electronic monitoring systems. In this section, authors numbered types of present systems and described in which situations systems these could be used. The fourth section presents examples of today’s implemented electronic monitoring systems. In the fifth section, authors proposed machine learning method for prediction based on the data collected from electronic monitoring system. The sixth section presents law acts from the law of enforcement sanctions and measures outside the prison, implemented to electronic monitoring. The final part contains conclusion and references.

2. ELECTRONIC MONITORING SYSTEMS

Various types of electronic monitoring devices have been developed over the years, with each successive generation improving upon its predecessors, both in terms of their functionality and portability. Some electronic monitoring devices are relatively simple and use Global Positioning Satellite (GPS) technology to alert the authorities when their wearers deviate from a pre-planned route. Others are more complex affairs designed to detect traces of alcohol or illegal drugs in the blood. In both cases, ankle bracelets can be powerful deterrents for convicts who might otherwise flout the terms of their probation sentences. In general electronic monitoring, equipment comes in two forms. The first form is so called active systems. These systems require an individual to wear a transmitter, usually in the form of an ankle bracelet, which continuously emits a signal to the receiver unit connected to his or her landline telephone (Shauna, 2007). A corresponding device in the person’s home relays the signal to a monitoring station. If the wearer strays too far from home or breaks the device, the authorities are alerted. Over time, their application expanded to areas outside the home, such as work and treatment programs. Variations were also developed that utilized mobile equipment allowing for the detection of the individual’s device, enabling authorities to conduct drive-bys of where the person should or should not be. In some other cases, active systems can be used to impose restrictions for some places where the person is not permitted to go. In such cases, systems impose restrictions through the installation of monitoring devices in places that are forbidden to an individual. If the wearer goes into those areas, an alert can be sounded and action taken. Active systems can also be used to restrict an individual’s access to other people if those people (for example, victims) are given a device that detects if the person under surveillance comes too close. The surveillance purpose can be achieved to some degree by placing monitoring devices at bus stops and train stations so that the individual can be tracked to and from work (Johnson, 1999).

The second form is so called passive system. In these systems, wearers are periodically contacted via telephone to ensure that they are where they are supposed to be. While a variety of different techniques have been used to confirm an offender’s presence with these systems, one of the more common means of achieving this goal requires the offender to wear a device strapped to his or her wrist which is inserted into a verifier box connected to the telephone when the computer calls. In this way, the system provides full confidence. Different technologies could be implemented to provide passive systems. For instance, passive systems may perform biometric fingerprint or retinal scans besides voice verification system. Some other techniques require the offender to respond to a pager, with caller-ID technology verifying the individual’s location. However, all passive systems are limited by the fact that they do not provide immediate notification of location or condition violations during the intervals between calls.

Both active and passive electronic monitoring systems can be used in three main situations. Those are detention, restriction and surveillance. Detention means that individual remains in a designated place. Restriction is a situation in which electronic monitoring can be used to ensure that an individual does not enter prescribed areas, or approach particular people, such as complainants, potential victims or even co-offenders. The last situation is restriction, which means that electronic monitoring may be used so that authorities can continuously track a person, without actually restricting their movements. As a result of the great number of limitations, there has been growing interest in the application of more advanced GPS technology as an alternative tool to enhance the supervision of offenders in the community (Lilly, 2006). GPS technology is available in both active and passive formats. GPS technology has the added advantage of being able to continuously track an offender’s movement 24 hours a day in “real time” when active systems are used. Passive GPS operates in a similar manner, but the location and movement data are downloaded, usually once a day, when the offender returns home and places the device in a cradle that connects to the monitoring agency. In both its active and passive forms, GPS technology essentially operates by receiving signals from a constellation of satellites which triangulate a position, and store or communicate that location to a monitoring center. In order to accomplish this feat, the individual must wear an ankle or wrist bracelet and carry a transmitter.

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3. TYPES OF ELECTRONIC MONITORING

Electronic ankle bracelets are often used for community corrections efforts. This type of bracelet is used in conjunction with a radio frequency base unit connected to a traditional telephone line. The reports sent over the phone by the base unit are usually monitored by a third-party contractor, although some law enforcement agencies take care of this function in some jurisdictions. There are several types of electronic monitoring devices that are commonly used (Hilf and Hilf, 2015).

GPS (Global Positioning System) Tether - this allows a defendant's movements to be tracked by satellite and reported to the appropriate supervising agency. Hot Zones (also known as Exclusion Zones) are programmed into a computer program that runs in conjunction with the GPS tether that alert authorities whenever the defendant goes someplace that he or she is not allowed (for example, the home or work of an alleged victim). GPS Tethers are common for persons charged or convicted of Criminal Sexual Assault, Domestic Violence, Stalking, or other crimes with a victim. In order to qualify for a GPS Tether, the Defendant must have a stable address and electricity at the address. Usually, if this is ordered, the Defendant is not released from custody until the GPS Tether is set up and functioning, and the alleged victim is notified as to the defendant being released on tether.

Transdermal Alcohol Tether - this type of tether monitors the defendant's skin to determine his or her Blood Alcohol Level that is usually attached to his or her ankle by a bracelet. It also monitors whether attempts to circumvent the system are made, based upon tampering with the equipment or a change in the defendant's body temperature. It is in use for alcohol defendant on probation, or home arrest.

Standard Tether - this device records and reports when a Defendant enters and exits his property. The Defendant must wear an ankle bracelet and have a landline phone for this device to properly work.

Breathalyzer Monitor - this can be installed in a Defendant's home or automobile, and does not require an ankle bracelet. The Defendant must submit to a Preliminary Breath Test when the unit calls the home. The unit is often equipped with a camera to verify that the Defendant is the person providing the breath sample. The Defendant must have a stable residence and a landline phone in order to qualify for this device.

Ignition Interlock Device - this is a breathalyzer installed into the Defendant's vehicle to prevent him or her from starting their car if alcohol is detected in their body. The driver must blow into the device and pass the alcohol test before the vehicle will start.

4. TODAYS ELECTRONIC MONITORING DEVICES

The ankle monitor is a sturdy and waterproof electronic device that cannot be removed. It will alert the base unit if it is tampered with, and the maximum range of this system is usually 3,000 ft within the radius of the base unit. Should the defendant move out of range, the base unit will emit a loud alarm and the monitoring agency will be immediately notified.

Defendants on home confinement may be allowed to work or go to school while wearing the device. To this end, the monitoring agency is notified of the job or class schedule so that the defendant is not mistakenly labeled as a fugitive.

The other type of ankle bracelet that uses GPS technology requires a mobile phone to be carried by the defendant in some cases. Some GPS ankle monitors incorporate the mobile phone into the device. In recent years, GPS ankle bracelets have been used to enforce restraining orders. Some examples of electronic ankle monitor that are in use are presented in continuation.

4.1. GPS LOCATION TRACKING - EXACUTRACK ONE

The ankle-mounted unit uses GPS data, and other location monitoring technologies, to accurately track a person's movement within local communities. It uses a combination of location technologies for improved reliability in more challenging environments such as indoors, moving vehicles or among very tall buildings. The lightweight unit is rugged, tamper-resistant, and has an extensive battery life. An optional beacon system can be used to reduce operational costs. The beacon is installed in the client's home, place of work, school or other designated location. When the individual enters an area where a beacon is located, the system switches modes from GPS tracking to traditional radio-frequency monitoring. When the person exits the beacon range, the system immediately shifts back to GPS tracking. Unlike other GPS tracking systems, ExacuTrack One enables officers to draw specific zones in any shape through Microsoft® MapPoint® and Bing™ Maps for Enterprise, industry-leading mapping technologies. The maps offer exacting detail making specific features on properties or neighborhoods clearly visible. When alerts are generated, officers can receive them via pager, e-mail, PDA or a combination of these methods. Supervising officers may also send pre-recorded voice messages to offenders through the ExacuTrack One tracking unit, useful for appointment reminders or to notify an offender upon entering a zone that is forbidden.

4.2. SCRAMX BRACELET

The patented SCRAMx ankle bracelet is attached to the user with a durable and tamper-proof strap. It is worn 24/7 by the user for the duration of his or her court-ordered abstinence period. Every half hour, the bracelet captures transdermal alcohol readings by sampling the insensible perspiration collected from the air above the skin. The bracelet stores the data and, at predetermined intervals, transmits it via a wireless radio-frequency (RF) signal to the base station. During installation, a SCRAMx base station is plugged into an analog telephone line – usually in the user's home or place of work. At a pre-scheduled time(s) each day, the SCRAMx bracelet communicates with the base station, which transmits alcohol readings, tamper alerts, and diagnostic data to SCRAMNET for detailed analysis and reporting. The base station also features an LCD screen that provides operation messages to the user (Barton, 2015). The range of a house arrest ankle bracelet can be between 3000 and 4000 sq. ft. At timed intervals, the ankle monitor sends a radio frequency or GPS signal to a receiver. If an offender moves outside of an allowed range, the police will be notified. The major drawback in this technology is that it is not specific to ethyl alcohol, the type of alcohol consumed by people. There are other types of alcohol that the fuel cell will read and report as a possible drinking event. Isopropyl alcohol is an alcohol commonly found in cleaning products. Methanol alcohol is the primary ingredient in the fuel burned by engines. Cetyl alcohol is found in many body washes and Jergens hand and body lotion. All of these alcohols, and others, will be detected by the SCRAM. The data generated by the fuel cell is interpreted exclusively by alcohol monitoring systems employees. They are the only people who are trained to determine if the alcohol readings are, in fact the result of a drinking event or if the readings were caused by an interferential. They make their determinations and conclusions primarily based upon the analysis of the graph the data creates.

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5. DATA PROCESSING FROM ELECTRONIC MONITORS

Modern electronic monitoring devices collect data and sending to the base station in some surveillance agency. Depending on the type of crime, different parameters from electronic monitors are important. If we have GPS monitored convicted person, the key parameter for that system is the distance from the boundary of restricted area, or his/her current position. For offenders that are in probation for physical assault distance from the victim is much important. As we said, alcohol measurements are important for alcohol offenders. To determine if the alcohol readings are from a drinking event or not, an employee in the agency must have a big experience. If we have a lot of offenders for the same offense, employees in the agency would have complex job to monitor all of them, and try to predict if some of them will repeat the same offence or not. The question is if computer based programs can do monitoring and prediction for us? All data from electronic monitoring device are sent to some database in the agency. The authors shall propose machine learning method which can be used for prediction.

First, data parameters that are collected must be classified by the same or similar offence. That is not a problem because the agencies already now classify offenders by criminal offence. For some offender, prediction will be based on one parameter, but for some other, prediction will depend on more than one parameter. In both cases, machine learning method can be used. As in all machine learning methods, accuracy of prediction depends on how big the learning set is. For this task, hypothesis and cost function are defined in Eq. 1 and Eq. 2 respectively.

$$h_\theta(\mathrm{x}) = \theta^T x = \theta_0 x_0 + \theta_1 x_1 + \theta_2 x_2 + \ldots + \theta_n x_0 \tag{1}$$

$$J(\theta_0, \theta_1, \ldots, \theta_n) = \frac{1}{2m}\sum_{i=1}^{m}(\mathrm{h}_\theta(\mathrm{x}^{(i)}) - \mathrm{y}^{(i)})^2 \tag{2}$$

Here $\theta_1, \theta_2, \ldots, \theta_n$ are hypothesis parameters, and $x_1, x_2, \ldots x_n$ are data from database based of which hypothesis provides an event. Parameters $\theta_1, \theta_2, \ldots, \theta_n$ are not individual parameter values, but are represented by n+1 dimensional vector θ. In Eq. 2, parameter m represents the number of training examples. Based on the parameters representation, cost function will be represented with $J(\theta)$. Cost function defines data linear regression. Pseudo algorithm for gradient descent is represented in Eq. 3, and gradient descent minimizes cost function.

$$\begin{aligned} &\mathrm{Repeat}\{ \\ &\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta) \\ &\} \end{aligned} \tag{3}$$

The most important parameters $\theta_1, \theta_2, \ldots, \theta_n$ must be simultaneously updated. The second part of Eq. 3, can be represented differently Eq. 4. In the previous equation, α represents learning rate. Depending on that parameter, gradient descents will figurate as larger or smaller step in the minimization process.

$$\frac{\partial}{\partial \theta_j} J(\theta) = \frac{1}{m}\sum_{i=1}^{m}(\mathrm{h}_\theta(\mathrm{x}^{(i)}) - \mathrm{y}^{(i)}) x_j^{(i)} \tag{4}$$

When we replace Eq. 4 in Eq. 3 we will get the final algorithm for gradient descent Eq. 5. For this algorithm also valid that θ_j must be updated simultaneously for every *j*. Here, we present the example of this algorithm for first three parameters Eq. 6, Eq. 7 and Eq. 8. Each step of gradient descent uses all the training examples.

$$\begin{aligned} &\mathrm{Repeat}\{ \\ &\theta_j := \theta_j - \alpha \frac{1}{m}\sum_{i=1}^{m}(\mathrm{h}_\theta(\mathrm{x}^{(i)}) - \mathrm{y}^{(i)}) x_j^{(i)} \\ &\} \end{aligned} \tag{5}$$

$$\theta_0 := \theta_0 - \alpha \frac{1}{m}\sum_{i=1}^{m}(\mathrm{h}_\theta(\mathrm{x}^{(i)}) - \mathrm{y}^{(i)}) x_0^{(i)} \tag{6}$$

$$\theta_1 := \theta_1 - \alpha \frac{1}{m}\sum_{i=1}^{m}(\mathrm{h}_\theta(\mathrm{x}^{(i)}) - \mathrm{y}^{(i)}) x_1^{(i)} \tag{7}$$

$$\theta_2 := \theta_2 - \alpha \frac{1}{m}\sum_{i=1}^{m}(\mathrm{h}_\theta(\mathrm{x}^{(i)}) - \mathrm{y}^{(i)}) x_2^{(i)} \tag{8}$$

Based on the above presented equations, update must be simultaneously. If implementation does not provide simultaneously update, values for parameters at the end of algorithm will not be correct. We must notice here that character *i* in the superscript for *x* does not represent power, but index. With this index and index in the subscript, the concrete data value from the database table will be used. Each θ_j parameter will be used in cost function calculation. After the cost function calculation, we must find minimal value for cost function, for the given θ_j and for the given hypothesis. Minimal cost function will provide best linear regression. In implementation, if we want to apply some hypotheses that can be implemented like matrix and vector multiplication, in the case of just one hypothesis, or matrix and matrix multiplication if we have multiple hypotheses. In some cases, if we have parameters of different sizes, some kind of scaling must be done. For example, if we have two types of parameters, one in the range from zero to two hundred, and second in the range from one to five. If we apply these parameters, we will get gradient descent that will provide a long time for calculation of minimal gradient descent value that can provide minimal cost function. To prevent this, all values in training samples for first parameters must be divided by the maximum value of the range, in our case two hundred, and the second parameters must be divided with five. This provides short time for gradient descent calculation. When we calculate the minimal value for gradient descent, and minimize cost function, we can compare cost function parameters and hypothesis representation. In the case of just one parameter, we will have linear representation for hypothesis, and some kind of parabola for cost function representation. Cost function is much complex for more than two parameters. In this case, cost function will be represented in 3D. Instead of display type in 3D, 2D presentation in the form of concentric circles can be used. In both cases, minimization of cost function must be applied. Implementation of gradient descent, cost function and hypothesis application is a complex job, for which specialized tools such as MatLab or Octave can be used. In case of these tools, implementation can be done very fast. The authors use Octave for this kind of problems implementation.

6. THE LAW OF ENFORCEMENT SANCTIONS AND MEASURES OUTSIDE THE PRISON

Electronic monitoring of convicts is regulated based on the concrete law acts. In the case of outside the prison electronic monitoring sanctions, these sanctions are regulated, and published in the official Gazette RS, number 55/2014. This law regulates the procedure for execution outside prison sanctions

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and measures imposed in criminal, misdemeanor or other court proceedings, which are executed in the community. Sanctions like these are implemented in order to protect the society from crime. This is provided by execution out of prison sanctions and measures in the community with the aim of re-socialization and reintegration of prisoners. The execution is carried out based on the decision of the public prosecutor, the court or at the request of the Institute for criminal sanctions execution. Based on thus, fifth member execution can be provided in different ways depending on the criminal act. By this member electronic monitoring can be used in different situations. First, it can be used for home detention, and measures of prohibition approaching, meeting or communicating with a particular person. The second situation is home arrest. In this case, electronic monitoring provides organization, implementation and monitoring execution of a sentence of imprisonment in premises where the convicted person resides. At the same time, electronic monitoring can provide supervision of conditionally released person and support that respects the constraints of the court. In this case, electronic surveillance may not last longer than one year, nor more than probation.

If a convicted person is in for home detention, the Court in its decision will indicate whether the measure of home detention is executed with or without the use of electronic supervision. The same decision must be indicated in the case of house arrest. Before making a decision on the execution of the sentence of house arrest with electronic surveillance application, the court shall determine whether there are technical and other possibilities for the execution of the sentence. If the court decides that the measure of house arrest is executed with the use of electronic surveillance, electronic surveillance equipment is activated immediately upon the delivery of the decision. A device for locating the defendant, that is safe for health, sets expert, who is thereby giving necessary instructions to the defendant on the method of operation of the device. Supervision agency manages the device that remotely monitors the movement of the defendant and his position in space. Electronic monitored convicted person in house arrest must not leave the premises in which he/she lived, except in cases stipulated by law. Accordingly, the convicted person shall have the right to stay out of room in that house for a maximum of two hours a day. By special decision, the convicted person may leave the premises in which he/she resides in some cases. For example, for providing necessary medical assistance, to go to work, take exams, classes at school, in case of the death of a close relative, *etc.* In such cases, the convicted abandons the premises in which he/she resides for over six hours, or twice for up to six hours, trust service notifies the court that brought the verdict. The court shall render a decision that convicted spends the rest of the prison sentence in the Institute for the execution of imprisonment and orders the issuance of arrest warrants. After this, the command for issuing the arrest warrants is delivered to the police authorities for execution. By this law, time spent on the run will not be counted as the time of execution of the sentence. Law enforcement sanctions and measures outside the prison provide full use of electronic monitoring and data processing from electronic monitoring devices.

CONCLUSIONS

The number of people around the world rises every day. According to statistics, the number of convicted persons rises every day too. Many of them have job, families, social life, but they are convicted for some offence, and must spend some time in prison. Some of them have been sentenced for serious offence, and some for minor offenses. All of them are in prisons. That is a logical sentence for the people who are returnees to the offenses, but for those convicted for the first time; the prison can be a horrible experience, especially for the people sentenced for minor offence. From the economical point of view, prisons are expensive, and many countries do not have money to properly maintain the prison buildings, pay guards and food for a large number of prisoners. Another approach is electronic monitoring of convicted persons, or persons on parole. The use of electronic monitoring device is a new term in criminal justice system, especially in our country. Systems like these are in use for a long time in many countries around the world. As we already said, those systems provide serving sentences in home environment, with family and without interrupting daily activities. From the social point of view, this is very important, because people who serve sentence like this have a chance for better life during the term of the sentence.

We must also not forget that those people have committed a criminal offense. With electronic monitoring they are out of prison, and they can repeat the same or similar criminal offence. In order to prevent that, they must be monitored all the time. Thus, the job officer must supervise the movement of convicted person, and based on all parameters predict if he/her will repeat the offence. This is a complex job that requires the appropriate experience. In this paper, the authors present their idea for the use of electronic monitoring devices, and data collected from electronic monitoring devices. Those data include the movement path, distance from the base station, distance from the restricted person, alcohol level, and use of drugs. Thus, we can create machine learning system which will predict future acts of convicted person. Such a system must be based on different kinds of hypothesis and heuristic. In that way, the system will predict, and inform the officer about critical situation. For such systems, training samples must be used. That is not limitation because we already have sufficiently available data, and each new monitoring convicted person can be used.

For future research, the authors plan to implement their idea as described in the paper. For job like this, data base form surveillance agencies must be used. The authors hope that they will find such database from some surveillance agency. They plan to implement all heuristic and prediction in Octave, and create framework in some programing language that will be used for data clustering and preparation, before processing in Octave. The system for data processing from electronic monitoring devices will be able to prevent criminal offence repetitions.

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