Speech Stress Analysis based on Lie Detector for Loyalty Test

Dr.A. Suresh and H. Shaheen

Abstract--- Human being has lot of virtual mask in their behaviour (mind or brain). By the way of probability study alone, be able to find a person's loyalty through their emotions, stress of speech, way of expressions and so on. It is not a novel technique to this world. The judgement and the hearings are finalizing in accordance to passed parameters (questions, transparent as well hidden test) and the result. Artificial Neural Network (ANN) is one of the best methods meant for speech stress analysing based cheap lie detection for the loyalty test. To show the results, polygraph is a comprehensible demonstration oriented approach. These methods are already used by the insurance fraud investigations and police. Through an individual's stress (stress percentage or else range) voice as well their emotions are able to detect the loyalty. Lie detection techniques require being extremely confidential and dynamic. For the reason that voice stress analysis (VSA) parameters have to be an encrypted for avoiding speech practise with testing tool. Here this paper, outlooks by using for predicting the liars through Speech VSA.

Keywords--- Speech, Voice, Emotion, Lie, Liars, ANN, ECG, EEG, Fuzzy Logic.

I. INTRODUCTION

Lie detector is a dynamic since on continuous practise be able to find the internal structure of the lie detector system. These are extremely simple to the frauds. Hence the methodologies have to be dynamic changeable by using ANN. With the blood pressure, ECG (pulse), EEG, count of eyes blinking per minutes, lip movements, hand and leg movements are necessitate to collect without their knowledge, these entire parameters are required to find the results. All the above mentioned will be discuss in this research paper. Through software application require to take more concentration through neural network of human being and the computer network system. This research concept totally depends upon physiological approach with Artificial neural network.

Aim of the Research

1. Through outside activities require to analyze an individual's truth words through fuzzy logic.
2. Collecting the entire possible probability activities meant for finding the reality or truth.
3. Require to develop a dynamic lie in ANN structure for finding lie detector.

II. RELATED RESEARCH

The United States judicial system places huge weights in the belief to juries are effectual and reliable in determining the credibility of the witness. However, behavioral and social research explains that humans are good at lying and quite poor at lie detection (Vrij, 2008).

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For exemplar, an average individual's capability to detect deception in a face-to-face interaction through another individual is merely modestly enhanced than chance (Ekman & O'Sullivan, 1991). Therefore, the significant of truthful testimony in addition to the inadequacy of human lie detectors encompass prompted the perennial search intended for a technology-based objective method of lie detection or else truth verification; this search continues nowadays (Grubin, 2010) polygraph, measures activity of the peripheral nervous system towards gauging truthfulness, has been the primary technical method intended for lie detection through the last century.

The *scenario* of a deception task refers in the direction of the hypothetical setting in experimental deception occurs. For illustration, a few experiments engage participants in a mock crime situation in addition question them about it (Kozel, 2005). Others probe participants concerning autobiographical information of dissimilar levels of intimacy (Abe, 2009). Ultimately, experiments to treated emotion, embarrassment in addition to autobiographical memory since confounds rather than variables of interest, used comparatively "neutral" scenarios to necessitated concealing possession of a playing card intended for a monetary reward. The task scenario as well determines the risk or benefit ratio of the deception experiment.

The investigational deception *model* refers towards the method used to generate deceptive responses in addition to the appropriate controls. The two fundamental deception-generating models are the CQT (Comparison Question Test) and the GKT (Guilty Knowledge Task), as well referred to since the CIT (Concealed Information Test). These models are not unique to MRI research along with have been developed intended for forensic investigative use (Stern, 2003) through the polygraph along with later through EEG (Rosenfeld, 1988).

An additional parameter of significance to the experimental deception-generating models is whether responding deceptively is being *endorsed* through the experimenter (Miller, 1993). Whereas in the real world, a person's deception would usually be undesirable to its target (a feature recognized to the deceiver, through definition), in most deception experiments, subjects are provided explicit instructions (i.e. endorsement) to lie to a few of the questions (Spence, 2001). Such endorsement severely limits the ecological validity of the experiment. A few deception experiments encompass attempted towards enhancing ecological validity to commence intent through allowing the subjects to choose while to lie during the task (Lee, 2002). Others have eliminated the appearance of endorsement of deception through separating the research team member who instructs participants to lie as of the rest of the team, therefore creating a "co-conspirator" (Langleben, 2005).

A rather new fraud approach that is becoming more common is the use of anonymous telephone hotlines (Holtfreter, 2004). It is an extremely cost effectual for detecting occupational fraud along with abuse. A hotline permits employees to give confidential, inside information without the fear of reprisal to accompany being a whistleblower (Pergola and Sprung, 2005).

Common Term

Better results are provided in big data and analysis of the functions according to the volume of information. To find out the better results, in testing parameters and constraints are increased on that time. These will be accurate in results, however in some time that might be unnecessary or else irrelevant. The generation of the report is compared

with the causes and matching. At present, different technologies are used to determine an individual's speech has truth percentage or else that speech have truth or lies.

Fraudulent financial reporting and asset misappropriation have turn out to be major costs for most of the organizations. To reduce the direct and indirect costs associated with all forms of, fraud numerous fraud prevention and detection techniques are now utilized. These different techniques comprise however they are not limited to: fraud policies, telephone hot lines, employee reference checks, fraud vulnerability reviews, vendor contract reviews and sanctions, analytical reviews (financial ratio analysis), password protection, firewalls, digital analysis and other forms of software technology, and discovery sampling (Carpenter and Mahoney, 2001; Thomas and Gibson, 2003). Organizations so as to have not been fraud victims depend more on intangible prevention tools similar to code of conduct or else fraud reporting policies whereas those to have suffered fraud have implemented additional tangible measures, for instance whistle-blowing policies and fraud prevention and detection training (Price Waterhouse Coopers (PWC), 2003).

Liars are so smart at present to interact through the police and investigation team. Therefore individuals require being extremely sharp compare with liars.

Polygraph Test

Polygraph machines are designed to detect the motion or else the waves in an asynchronous or simultaneous process in addition to this by using at health care or medical segments headed to record changes in physiological unexpected changes on characteristics. That might be an individual's pulse rate, breathing rate per minute along with these are used at a same time for detect liars (lie detection). In the lie detection system individual has to consider a few of the most important characteristics that might be controllable with the assistance of human otherwise uncontrollable characteristics. The sources are listed beneath,

1. Direct speech by means of eye sight
2. Answering with no relevant
3. Answer indirectly
4. Irregular speech vs. flow of regular speech
5. Questionnaire preparation
6. Answering speed
7. Polygram verification (Variation)
8. Report of EEG /ECG

Little Self-control and Sensitivity to Reward

An additional interesting dissimilarity was to discover between non-criminal individuals with multiple psychopathic traits and criminal people through psychopathic traits. There is dissimilarity in the communication among the reward centre as well an area in the middle of the forebrain. Excellent communication among these areas might appear to be a condition meant for self-control. Here the outcomes seem to indicate so as to the tendency

towards committing an offence arises as of a combination of a strong focus on reward along with lack of self-control. This is said to be the initial research project where convicted criminals were actually examined.

Here individual can find a few of the physiological waves through the speech. A few of the similar wave files are declared in figures. The reports are generated from the Speech Analyzer Software. The fuzzy logic is applicable in these terms as well. Since every question needs to finalizes the result no one is not able to give percentage of truth or the percentage of lie. By receiving the answer alone one can compare with another question and its answer. In the same time through ANN concept the entire combination of question will calculate the final outcomes.

Sample

Police Enquiry Question: When you plan to rob the cash from the bank?

Normal Person: No sir, I came to deposit the cash, in the meanwhile they tried to snatch the cash from the casher.
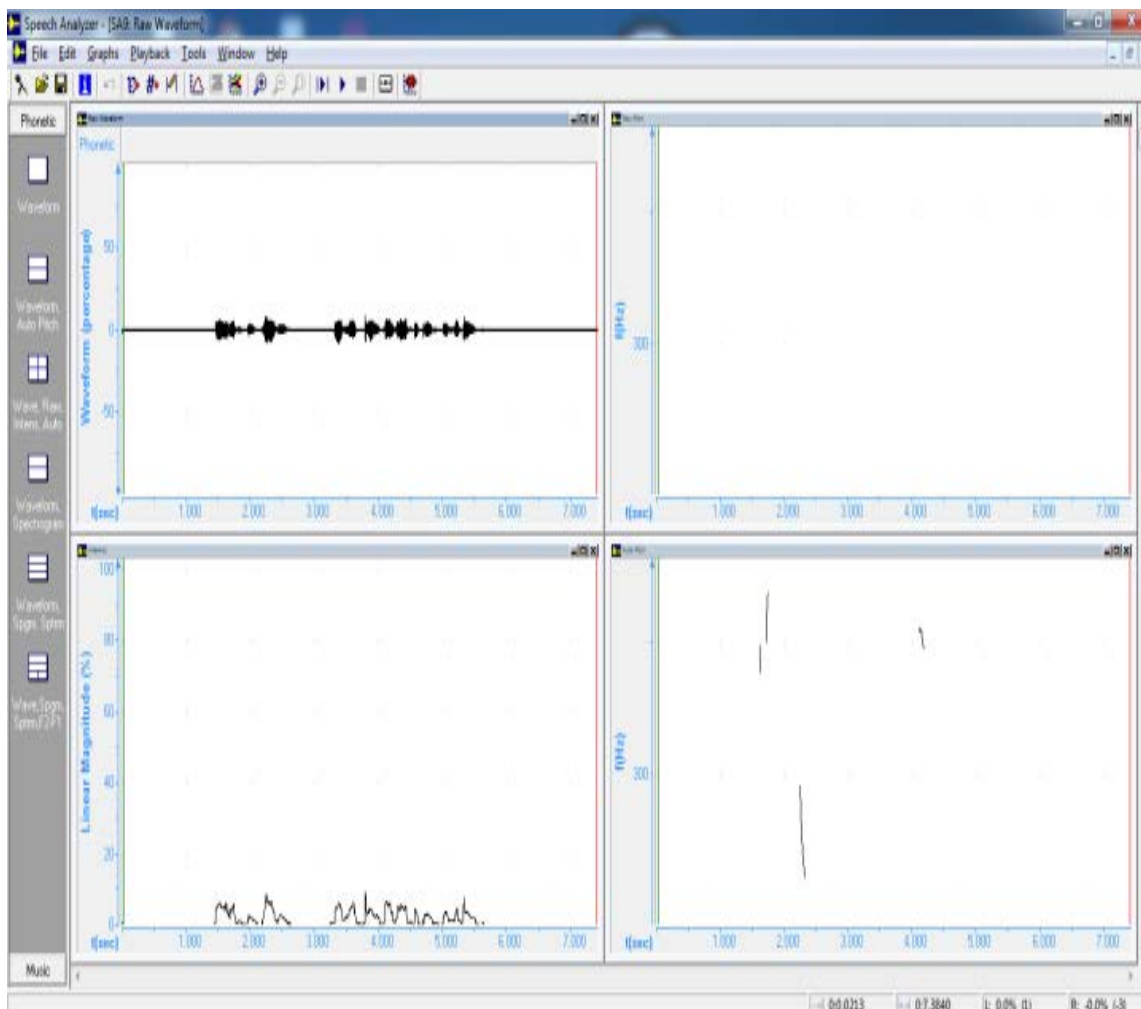
Liar: I was not in the picture.
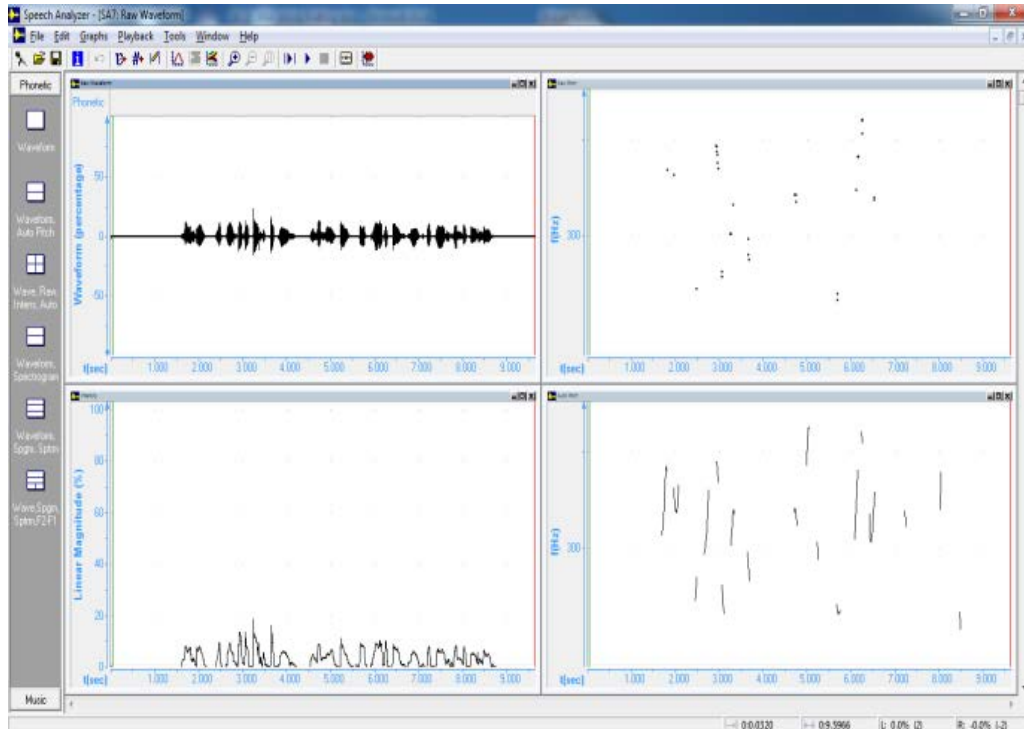

Figure 1: Police Enquiry (Police Voice)

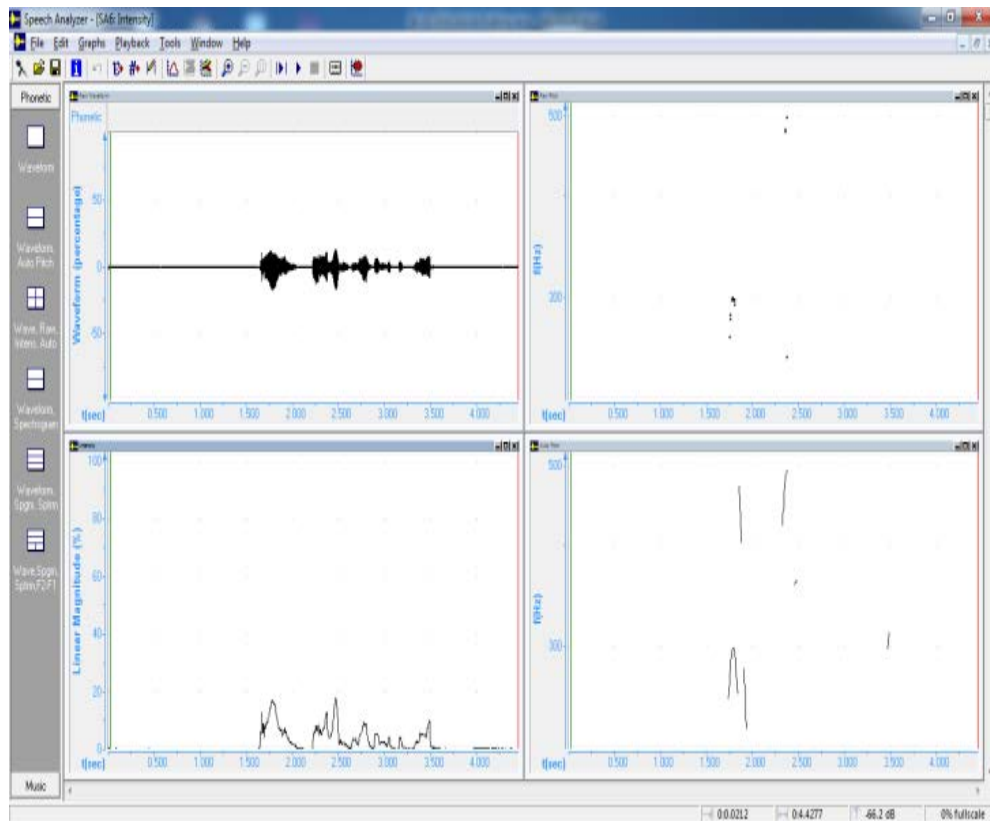Figure 2: Voice Speech of a Normal Person (Normal Pitch)

Figure 3: Voice Speech of an Abnormal Person (High Pitch)

By these three individuals voice, speech of polygraph result has a dissimilar voice modulations. There is a difference in pitch value. Through pitch value individual can find the emotions of the speech. Through well trained liar or else fraud include complete training to be extremely polite in police enquiry.

Measurements of Brain Function

Polygraph and other measures of autonomic along with somatic activity reflect the peripheral manifestations of extremely complex cognitive in addition to affective operations to occur while people give deceptive or else non-deceptive answers to questions. Through their extremely nature, polygraph measurements give a really limited and indirect view of the complex underlying brain processes. A reasonable hypothesis is to by looking at brain function additional directly, it may be possible to understand in addition to ultimately detect deception. Through EEG report individual finds the polygraph of an individual's measurement at that spot. Electroencephalography (EEG) is the measurement of electrical activity produced through the brain as recorded as of electrodes placed on the scalp.

A lot of criminal offenders display psychopathic traits, like antisocial and impulsive behaviour. Moreover, however a few persons with psychopathic traits do not commit offences meant for which they are convicted. As through any other form of behaviour, psychopathic behaviour has a neurobiological basis.
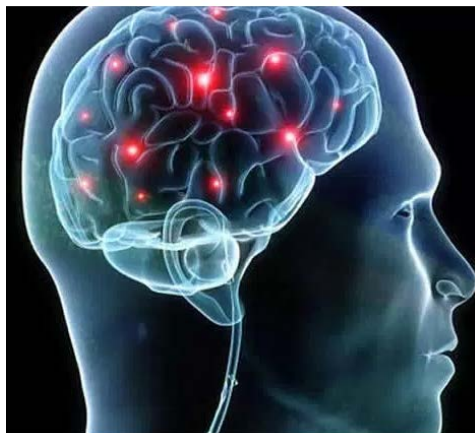

Figure 4: Human's Brain with Actions

III.   ANN WITH LIE DETECTION

To attain human subjects' approval, individual required to comply through Committee. For this, individual required to give documentation detailing the experimental protocol, subject con-sent procedures and subject recruitment. It was essential to explicitly explain each type of data collected as of the subjects and the equipment used in the study. To comply through these regulations, individual had to create sure to personally identifiable subject in formation was not comprised in the data that was collected. The selected parametric questions, comparing charts, related and unrelated merging, swapping the answer intended for dissimilar question these entire are coming into ANN root cells. Here, essential ANN explained through question also probability of the answers through diagrammatic form (fig)
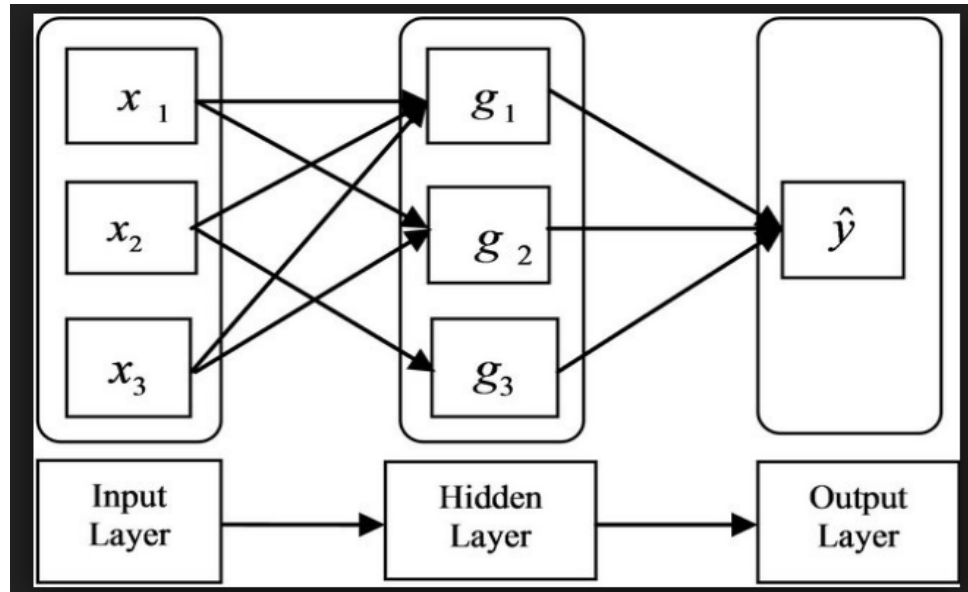
ANN Internal Structure

Table 1 and figure 4 providing the average result part or detection of lie result.

Table 1: Lie Detector Probability Analysed Values

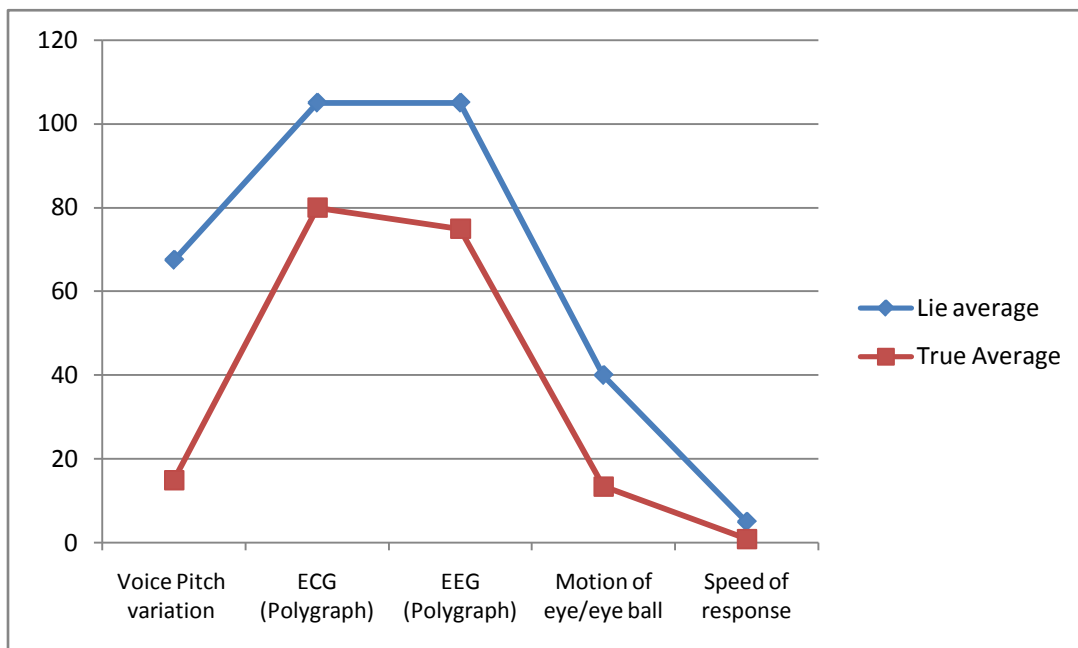| S.No	Parameters	Measurement	Lie	Lie average	True	True Average
1	Voice Pitch variation	Magnitude	35% - 100%	67.5	10%-20%	15
2	ECG (Polygraph)	Beats(bpm)	90-120	105	60-100	80
3	EEG (Polygraph)	Beats(bpm)	90-120	105	60-90	75
4	Motion of eye/eye ball	Occurrence	5-75	40	12-15	13.5
5	Speed of response	Time	0 to 10 sec	5	0 to 2 sec	1

Figure 4: Comparative Result based on Parameters

IV.   CONCLUSION

Here this result specifies that it is probable to correlate the speech stress, lying and also interest through a variety of physiological features. By using Artificial Neural Network, one is able to identify high stress situations around 92 % accuracy. Individual can even detect lying about 81% accuracy. Fundamentally, here it is demonstrated that individual can identify these events as of simple aggregated physiological features obtained during the duration of the events in question as of non-invasively derived sensing. This structural ANN is able to update for getting the enhanced results.

REFERENCES

[1]   N. Abe, T. Fujii, K. Hirayama, A. Takeda, Y. Hosokai, T. Ishioka and H. Fukuda, "Do parkinsonian patients have trouble telling lies?", The neurobiological basis of deceptive behaviour, Brain, Vol. 132, No. 5, Pp.1386-1395, 2009.

[2]   B.W. Carpenter and D.P. Mahoney, "Analyzing organizational fraud", Internal Auditor, Pp. 33-38, 2001.

[3]   P. Ekman and M. O'Sullivan, "Who can catch a liar?", American Psychologist, Vol. 46, Pp. 913-920, 1991.

[4]   D. Grubin, "The polygraph and forensic psychiatry", Journal of the American Academy of Psychiatry & the Law, Vol. 38, Pp. 446-451, 2010.

[5]   K. Holtfreter, "Fraud in US organisations: an examination of control mechanisms", Journal of Financial Crime, Vol. 12, No. 1, Pp. 88-95, 2004.

[6]   J.L. Bierstaker, R.G. Brody and C. Pacini, "Accountants' perceptions regarding fraud detection and prevention methods", Managerial Auditing Journal, Vol. 21, No. 5, Pp. 520-535, 2006.

[7]   F.A. Kozel, K.A. Johnson, Q. Mu, E.L. Grenesko, S.J. Laken and M.S. George, "Detecting deception using functional magnetic resonance imaging", Biological Psychiatry, 2005.

[8]   D.D. Langleben, J.W. Loughead, W.B. Bilker, K. Ruparel, A.R. Childress, S.I. Busch and R.C. Gur, "Telling truth from lie in individual subjects with fast event-related fMRI", Human Brain Mapping, Vol. 26, No. 4, Pp. 262-272, 2005.

[9]   T.M. Lee, H.L. Liu, L.H. Tan, C.C. Chan, S. Mahankali, C.M. Feng and J.H. Gao, "Lie detection by functional magnetic resonance imaging", Human Brain Mapping, Vol. 15, No. 3, Pp. 157-164, 2002.

[10]   G.R. Miller and J.B. Stiff, "Deceptive Communication", Deceptive Communication, Vol.14, Pp. 32–39, 1993.

[11]   C.W. Pergola and P.C. Sprung, "Developing a genuine anti-fraud environment", Risk Management, Vol. 52 No. 3, 2005.

[12]   Price Waterhouse Coopers (PWC), Global Economic Crime Survey, 2003.
www. pwcglobal.com/extweb/ncsurvers.nsf.

[13]   J.P. Rosenfeld, B. Cantwell, V.T. Nasman, V. Wojdac, S. Ivanov and L. Mazzeri, "A modified, event-related potential-based guilty knowledge test", International Journal of Neuroscience, Vol. 42, Pp. 157-161, 1988.

[14]   S.A. Spence, T.F. Farrow, A.E. Herford, I.D. Wilkinson, Y. Zheng and P.W. Woodruff, "Behavioural and functional anatomical correlates of deception in humans", Neuroreport, 2001.

[15]   P.C. Stern, "The polygraph and lie detection", Report of the National Research Council Committee to Review the Scientific Evidence on the Polygraph, 2003.

[16]   A. Vrij, "Detecting lies and deceit: Pitfalls and opportunities, John Wiley & Sons, 2008.