Review Article

Design of smartphone capturing subtle emotional behavior

Abstract

Our goal is to design Smartphone AI to help the law enforcement to catch suicide terrorists a few minutes early, in order to prevent senseless killing and eradicate someday the pandemic terrorist entirely with the omnipotent Smartphone loaded with either passive camera with IR filter (R 72) Near IR 0.8 , or active *Short Wave Infrared (SWIR) 0.8-2* μm video & Smart Deep Learning Algorithm. This is not possible without current success of Internet Giants developed powerful AI Artificial Neural Network (ANN) expert system that can surpass human in Alpha Go. We choose South Korea, among others, for their success of counter terrorists, despite of the adversary threatening. Our working hypothesis is that suicide behavior begins with the Amygdale negative feeling of "hope-less, help-less, worth-less," (cf. US Army Training Manuel, 2015)escalating the "LESS triangle loop psychology, which are furthermore compounded with the self-ridiculous rationalism at Hippocampus such as the political ideology, religion or the other belief system, in order to sacrifice hundreds innocent life. From the sensory consideration in the preliminary design, we wish to install SWIR active imaging about $300 in the Smartphone MEMS platform near day video that can *track covertly the facial Dynamics Vein Map (DVM)* at a safe distance, because the terrorist has a hot bubbling blood circulating through the face, head and core body revealing psychologically the trouble that the alleged terrorists might initiate suicide detonation without knowing his or her own intention which has already been detected by Smartphone Active SWIR Video of DVM computed with the Deep Learning Algorithm in real-time phase transition.

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Introduction

We wish to apply AI ANN machine learning to detect ahead of time Suicidal Terrorists. The complexity of such a subtle emotional response forms a class of cohort biometrics involving IQ, e-IQ, culture, religion, belief. Biologically, we assert that relatively retarded Hippocampus for associative memory IQ and small Amygdale sizes for low social skill e-IQ that might attribute to the Suicidal Terrorist behavior. Smartphone, Day and Night Video (Short Wave Infrared (SWIR) 0.8-1 micron Digital Video Imaging Camera are indicated in (Figures 1–3)
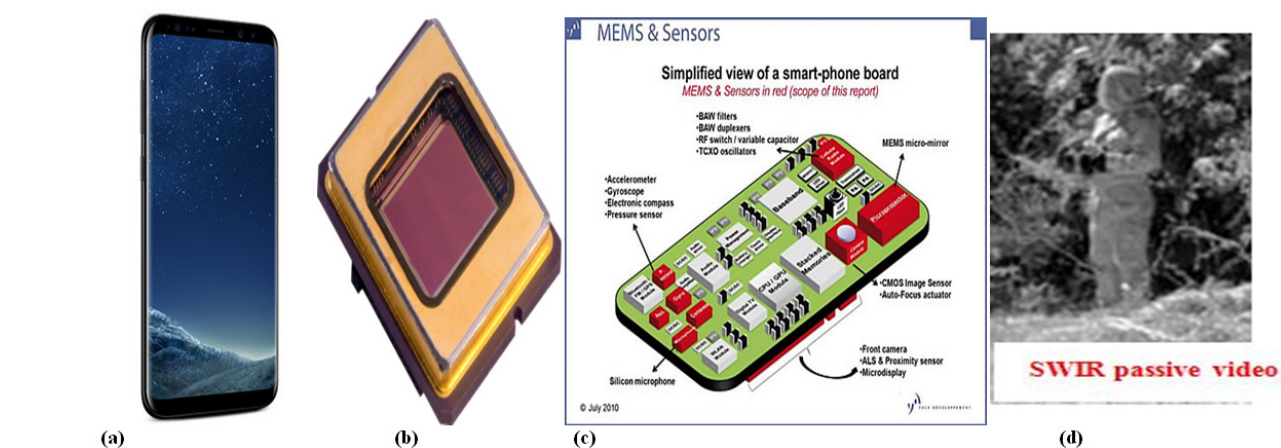

Figure 1

(A) SWIR Video Imaging Technology,

(B) SWIR CMOS; 60 frames per second full frame rate; 1920x1080 pixel format, 10µm pitch. Capability for 100% duty cycle across entire illumination intensity range; High sensitivity in 0.9 to 1.7µm spectrum; NIR/ SWIR, from 0.7 to 1.7µm; VIS/SWIR from 0.5 to 1.7µm (option); Digital 12-bit output; Operation from -40 to+70°C;

(C) MEMS & day video Camera of Smartphone;

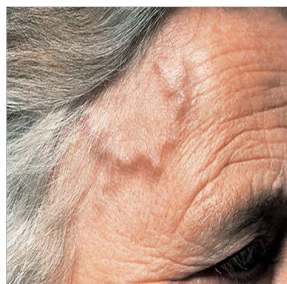(D) Visible Exemplar for long distance active SWIR invisible image.

Figure 2 Dynamic Vein Map (DVM) is shown in active illuminating near infrared image SWIR video that is not visible to human visual system that is also covert to the terrorist. For display purpose, we demonstrated herewith an equivalent day picture for facial stress popping vein dynamics.
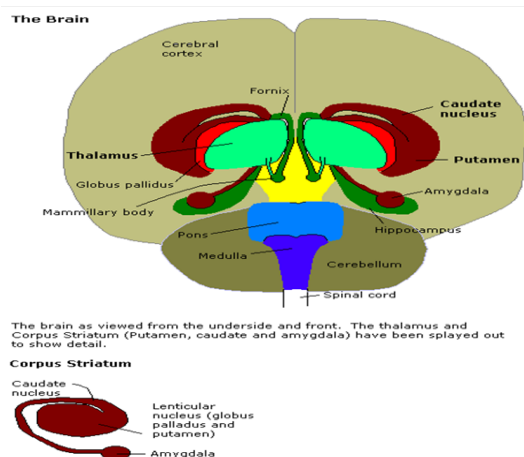

Figure 3 The smaller Amygdales lead to the negative feeling of "self-worthless, hopeless, helpless" (Army Training Manuel 2015) when compounded with retarded Hippocampus Associative Memory brain can be easily washed with self-justified Terrorism, i.e. illogically commits other massive suicides namely.

(A) Homosapiens Emotion is located at 2 Amygdales (in Latin: Almond shape cf. Wikipedia) in the brain Limbic system that can activate the Sympathetic Nervous System that flood the body with stress hormone. Acute phobias.

(B) The size of Amygdale is critical to the social skill, responsible for "fight or flight," and, in the extreme, suicide intention (cf. Wikipedia).

Approach

Working Hypothesis is that Homosapiens with smaller Amygdales and smaller Hippocampus are prune to be brain washed to be lacking the emotional apathy and associative memory knowledge to be brain washed to indoctrinate as suicide bombers of suicide terrorists. This could not be directly proved except invasively in the mice (to be done with ethical protocol for aging mice). The larger Amygdale enables a greater societal integration and cooperation with other and the level of a person's emotional intelligence. How to develop healthy Amygdales riding on Hippocampus Associative Memory is critical for the healthy psychology. When one is young, the scouting team work is a good training. One shall be active in sports activity to release the negative feeling of self- depreciation (Figure 4).
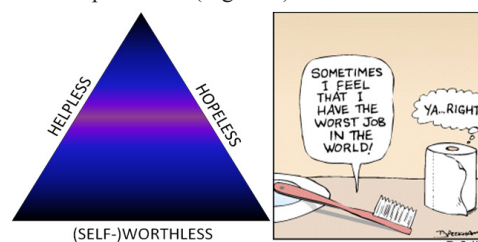
Figure 4 Negative Loop of "LESS" Triangle that can be escalated into the Suicidal Psychology (US Army Training Manuel 2015); the Carton is taken from an unknown Artist how to break the vicious circle.

Historical perspective of suicide terrorism

Historical perspective of suicide terrorism begins long and long ago (Figure 5), rather than enumerate all the events we shall summarize these events with a set of critical questions.

A. Is suicide terrorist preventive, & pre-emptive?

B. Can the Unified Deep Learning Machine Learning capture the intuition and haunch for good or "bad guy-logy" of those experienced law enforcement?

C. Terrorists happened everywhere: a coffee shop in Paris suffered with100 casualties, happened 3 times in London, so was in the U.S (Columbine High School, the Virginia Tech or Sandy Hook Elementary School) driven by personal/psychological, not necessarily political, social or religious causes.

D. Why terrorists that might have happened but not materialized in South Korea (certainly not big events in the World NEWS)?

E. How to capture by bionic smart sensors pairs, such for hawk eyes, cat ears, & dog nose, to develops the training data to be furthermore down selected by Korea Law Enforcement? (Figures 5–8)

A shortfall: "cohort biometrics" involving the psychology and intention for suicide terrorism at a distance

6 decades USS Bunker Hill (CV-17) after a *Kamikaze* attack by the Imperial Japanese Navy on May 11, 1945

The World Trade Center in New York City came under *UNI75* terrorists 17 suicide attack on *September 11, 2001, killed 2996 (344 fire fighters 71 police, >90 countries) (jet fuel melt down metal core)*
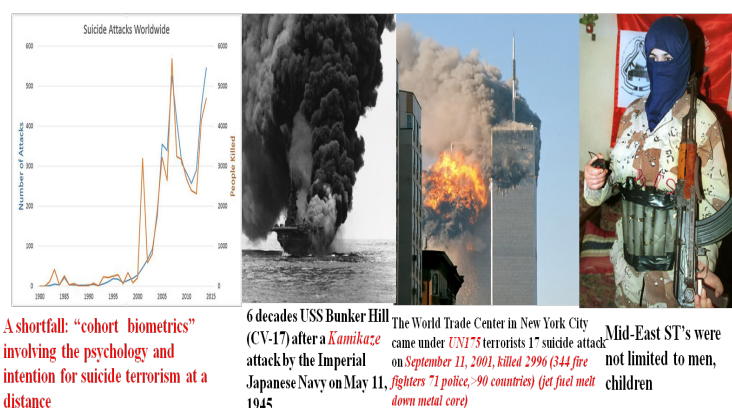
Mid-East ST's were not limited to men, children

Figure 5
(A) The World-Wide Terrorist Causality are increased to 5 thousands & 8 hundreds.
(B) It began with 6 decades ago during WWII Imperial Japan Kamikaze attacking USS Bunker Hill,
(C) 16 Suicide Terrorists droved on September 11 2001 United Airline 175 to the World Trade Center (WTC) killed 2996 people (344 fire fighter and 71 police, over 90 countries). The collapse of WTC has been determined to be due to the jet fuel melted the mental core of WTC.

(D) Suicide Terrorists are no longer limited to man & children.

Figure 6 JTBC reported Korea Counter Terrorist Program, cf. YouTube for training.

Figure 7 Counter Terrorists Wide Spread Effort begins with k-12 School Counter Bullying in Korea.

Figure 8 Anti-Riot, bullying Training Employing both Police Martial Arts, Policewoman Intuitions.

AI ANN & NI BNN training protocol

Deep Learning implies multiple layers of neural networks for multiple features extraction to increase the probability of detection of overly stressed emotion intelligence, and to reduce the false alarm rate. This is similar to biological neural network (BNN) is Human Visual System (HVS) in the back of head Cortex 17 area withV1 layer to V-4 layer. While false positive is nuisance, false negative is detrimental to other innocent bystanders. Result of Studies favor passive Near Infrared (NIR) using Filter R70 or active SWIR choice will be presented elsewhere. We will only show day image mock ups for legible journal printing reasons. Dynamic Vein Map (DVM) tells the detonation exit time behavior of a terrorist. How to measure stress e-IQ for preemptive ST, we recommend to track mood/temper change by illuminating at a distance with Short Wave Infrared (SWIR) or passive near infrared (0.8m) light penetration processing pseudo-real time video recording. One of the reasons why South Korea has no suicide terrorists because Asian culture values precious life after a half century of war followed with the reconstruction into prosperity by means of heavy industrialization in steel ship manufactory and electronics semiconductor chips DRAM as well as communication Smartphone Information Technology. On the other hand, there is very strict gun control law in Korea, both North & South. There are also a plenty of lower end labor market jobs, that are available for the Northern people working either legally in the demilitarized zone or illegally in Seoul. Useful war experience has been transformed into the peacetime 1st class policing training, in both policemen martial artists & policewomen in keen observation and sensitivity (Figure 9).

Figure 9 Persistent Surveillance in Daily Training of Law Enforcement is perhaps one of the key remediation's to Counter Terrorists.

Investigation of smart sensor algorithm

Saliency is necessary to avoid over-fitting or lacking of d. o. f. Some spectral does not propagate far in air. See through cloths with two separated polarization at either at PMMW, Terra Hz (sub mm wave), or Police Speed Gun DHS Body Scan using Passive Millimeter Wave 3 mm wave (80 GHz~100GHz) which like radiometer reads passive infrared heat radiation occluded by solid metal object then it penetrates through the cloth to camera Terrorist Cohort Biometrics "You don't have it, you can't get it" No matter how powerful is: AI ANN Deep Learning." Nothing can do the magic, unless you have all the silent features---by smart power of pairs of eyes, ears, nostrils, etc.[1–2] Those data gathered will be further down selected by seasoned Law Enforcement to avoid over fitting or missing d. o. f. Design Architecture: layers of ANN, shape of hidden layers (Hourly Glass, or Beer Barrel), and dynamic learning the architecture?

"Proof of Pudding is at eating" Test & Evaluation in Lab, in Fields (Figure 10).

Machine learning requires smart AI ANN deep learning algorithms[3,4]

We can extend medical Static contact Vein map as biometric ID using ultrasound & NIRAI Expert System Logic is simply a set of programming logic based on

IF......

Then......

Return. (1)

ANN begin with data Vector Time Series for Power of Pairs [2]:

$$\overrightarrow{X}_{pairs}\left(t\right) = \left[A_{ij}\right]\overrightarrow{S}_{pairs}\left(t\right) \tag{2}$$

And the inverse is solved by the Convolution Neural Network (CNN):

$$\hat{S}_{pairs}\left(t\right) = \left[W_{ji}\left(t\right)\right]\overrightarrow{X}_{pairs}\left(t\right) \tag{3}$$

ANN are derived from Natural Intelligence (NI) hat generalize the Least Mean Squares (LMS) errors cost function to thermodynamic minimum free energy (MFE) H=E-TS cost function based on constant brain temperature at 370C, where the disagreement noise of pair of eyes and ears will be decaying rapidly to the thermal equilibrium.

Theorem 1: Natural Intelligence[5] Cost Function is based on the Physics that all animal brains are kept homeostasis at the constant temperature of brain in the outside environment (env.)

Boltzmann $S_{tot} = S_{brain} + S_{env.} = k_B \log W_{MB}$

(4)

Maxwell-Boltzmann probability

$$W_{MB} = \exp\left(\frac{S_{tot}}{k_B}\right) = \exp\left(\frac{\left(S_{brain}+S_{env.}\right)T_o}{k_B T_o}\right) = \exp\left(\frac{S_{brain}T_o - E_{brain}}{k_B T_o}\right) = \exp\left(-\frac{H_{brain}}{k_B T_o}\right)$$

(5)

$$\Delta S_{tot} > 0 \tag{6}$$

NI is based on Boltzmann total entropy of brain and environment that were implicated by Eq (4-6) the Helmholtz MFE: $\Delta H_{brain} \equiv \Delta E_{brain} - T_o \Delta S_{brain} \leq 0$ because of $T_o = const.$ and the irreversible thermodynamics implicated the brain eventual heat death $\Delta S_{brain} > 0$

Lyaponov

$$\frac{\Delta H_{brain}}{\Delta t} = \left(\frac{\Delta H_{brain}}{\Delta\left[W_{i,j}\right]} \right) \frac{\Delta\left[W_{i,j}\right]}{\Delta t} = -\frac{\Delta\left[W_{i,j}\right]}{\Delta t}\frac{\Delta\left[W_{i,j}\right]}{\Delta t} = -(\frac{\Delta\left[W_{i,j}\right]}{\Delta t})^2 \le 0$$

(7)

$$Newton\ \frac{\Delta\left[W_{i,j}\right]}{\Delta t} = -\frac{\Delta H_{brain}}{\Delta\left[W_{i,j}\right]}$$

(8)

Hebb

$$\frac{\ddot{A}\left[W_{i,j}\right]}{\ddot{A}t} \equiv -\frac{\Delta H_{brain}}{\ddot{A}\left[W_{i,j}\right]} = \left(-\frac{\Delta H_{brain}}{\Delta\overrightarrow{Dendrite_j}} \right)\frac{\ddot{A}\overrightarrow{Dendrite_j}}{\ddot{A}\left[W_{i,j}\right]} \equiv \bar{g}_j\vec{S}_i$$

(9)

Dendrite input

$$D_i \equiv \Sigma_k\left[W_{i,k}\right]S_k$$

(10)

Glial Cells

$$g_j = \sigma_j^{(')}\left(dendrite_j\right)\Sigma_k \tilde{g}_k\left[W_{k,j}\right]$$

(15)

Both Supervised Deep Learning (SDL) or Unsupervised Deep

$$\bar{g}_j \equiv \left(-\frac{\Delta H_{brain}}{\Delta\overrightarrow{Dendrite_j}} \right)$$

(11)

Sigmoid threshold neuron

$$S_i = \sigma\left(\Sigma_{j=X1}^X W_{ij}X_j - \theta_i\right) \ge 0$$

(12)

Theorem 2: Unified Deep Learning is possible because of the same physiology the learning logic observed by Canadian D.O. Hebb learning 5 decades ago, i.e. "wired together and fired together (WTFT)" for merely different cost functions (LMS for ANN; MFE for BNN).

Proof: From Theorem 1 of MFE follows the Glail Cells definition

$$g_j \equiv -\frac{\partial H_{brain}}{\partial dendrite_j} = -\frac{\partial H_{brain}}{\partial S_j}\frac{\partial S_j}{\partial dendrite_j} = -\frac{\partial H_{brain}}{\partial S_j}\sigma_j^{(')}\left(dendrite_j\right)$$
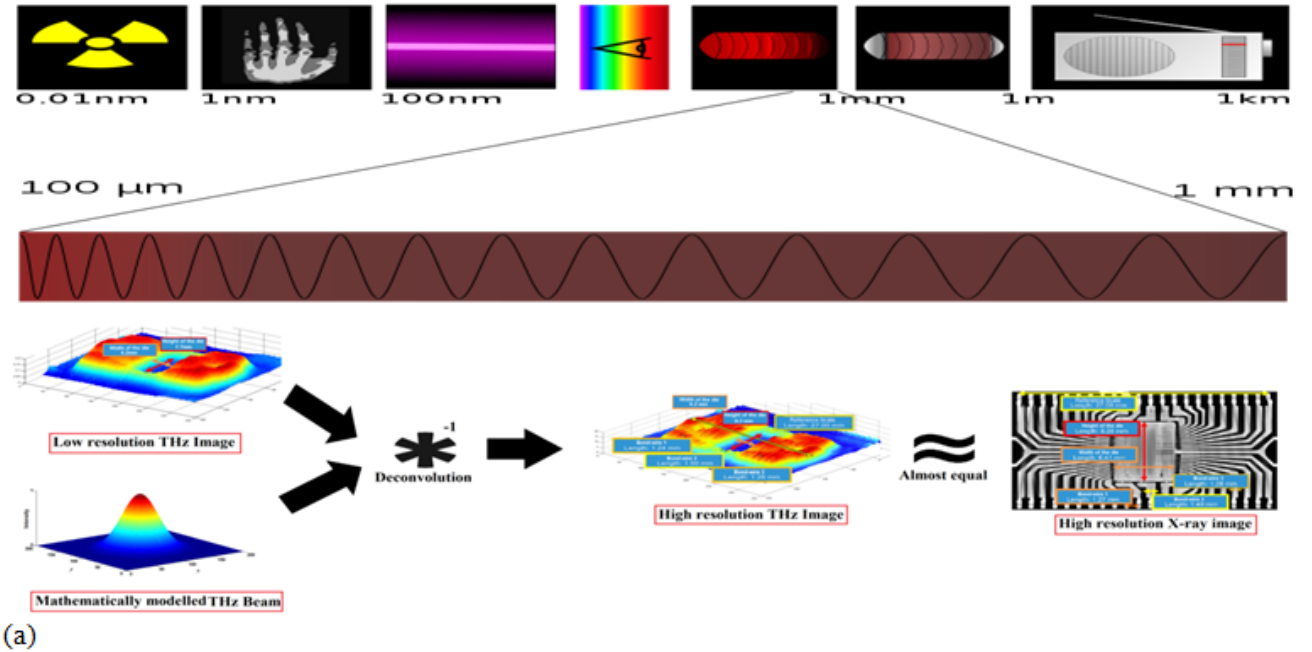
(13)

where

$$-\frac{\partial H_{brain}}{\partial S_j} = -\Sigma_k\frac{\partial H_{brain}}{\partial dendrite_k}\frac{\partial dendrite_k}{\partial S_j} - \Sigma_k\frac{\partial H_{brain}}{\partial dendrite_k}\frac{\partial}{\partial S_j}\Sigma_i\left[W_{k,i}\right]S_i = \Sigma_k\tilde{g}_k\left[W_{k,j}\right]$$

(14)

Learning (UDL) are self-similarly derived within the derivative of the sigmoid window function $\sigma_j^{(')}\left(dendrite_j\right); \sigma_j^{(')}\left(net_j\right) : \Theta\left(\Delta t\right) =$ in terms of the backward error propagation algorithms are isomorphic:

$$\left[W_{ji}\left(t+1\right)\right] - \left[W_{ji}\left(t\right)\right] = \begin{cases} \eta\bar{S}_i\sigma_j\left(dendrite_j\right)\left\{1 - \sigma_j\left(dendrite\right)\right\}\Sigma_k\tilde{g}_k\left[W_{k,j}\right] + \alpha_{momtum}\left[W_{ji}\left(t\right) - \left[W_{ji}\left(t-1\right)\right]\right] \\ \eta\bar{S}_i\sigma_j\left(net_j\right)\left\{1 - \sigma_j\left(net_j\right)\right\}\Sigma_k\tilde{\delta}_k\left[W_{k,j}\right] + \alpha_{momtum}\left[W_{ji}\left(t\right) - \left[W_{ji}\left(t-1\right)\right]\right] \end{cases}$$
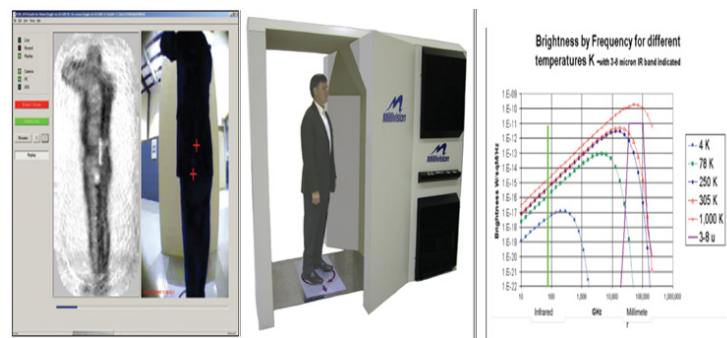
(16a,b)

(a)

(b)

(c)

[Fujitsu Corp.]
(d)

(e)

Figure 10

(A) Comprehensive Electromagnetic Spectra for Sensors,

(B) Passive Sub Mille Meter Wave (PMMW) used in Airport,

(C) Terra Hz experiments,

(D) Japan company develop Vein Map,

(E) Image processing for facial stress vein popping.

This is precisely the multiple layer Backward Error Propagation (Back Prop) algorithm derived in PDP book MIT Press 1984 David Ruhmelhart and James Mccell and, as well as independently by Paul Werbos, Ph D Thesis of Harvard. Emotion stress can be implicated from the facial image, e.g. crowded eye brows, lips curvature down.[6–9] (day images are taken from Google/Cloud for illustration purpose, while our device will use passive NIR or active SWIR not printable in the paper (Figure 11). The Back Prop code is available free on Internet as Tensor Flow in Python language. or in Mat-lab Code. Thus, we shall refrain ourselves to demonstrate the simulation results (Figure 12).

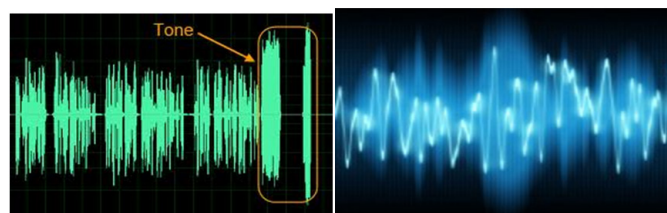**Figure 11** As well as voice intonation Let us go versus Let's Go.

Figure 12 Those inputs enter as the training set of the Back Prop Algorithm as we demand the interpretation as the degree of stress levels so the weight matrix will be changed n multiple layers according to D.O. Hebb rule Eq(16a,b).

Conclusion

We believe if one registers on Cloud Data Basis, one can find a lot more image & voice training exemplars which can then pass through the Expert Experience of Korean Law Enforcement to down select into salient feature vectors. Then we can train the current Smartphone which has already powerful mini-super computing capability, fast enough to be pseudo real-time to process the deep learning to decide the decision aids to users in the world wide. This is an on-going report and we decide to open up to solicit world-wide participate or independent effort to solve man-created problem with man science & technology. A journey of thousands miles, it must begin with the first step, We believe active SWIR Smartphone Video taking the facial Dynamic Vein Map may be a so far sensitive approach. We have begun the first step so long as pointing in the right direction.

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Conflict of interest

Author declares that there is no conflict of interest.

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Authors Biography

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Dr. Harold HwaLing Szu has been a champion of Unsupervised Deep Learning Computational brain-style Natural Intelligence for 3 decades. He received the INNS D. Gabor Award in 1997 "for outstanding contribution to neural network applications in information sciences. He pioneered the implementations of fast simulated annealing search. He received the Eduardo R. Caianiello Award in 1999 from the Italy Academy for "elucidating and implementing a chaotic neural net as a dynamic realization for fuzzy logic membership function. Dr. Szu is a foreign academician of Russian Academy of Nonlinear Sciences for his interdisciplinary Physicist-Physiology to Learning (#135, Jan 15, 1999, St. Petersburg). He is a Fellow of American. Institute Medicine & Bio Engineering 2004 for passive spectrogram diagnoses of cancers; Fellow of IEEE (#1075,1997) for bi-sensor fusion; Fellow of Optical Society America (1995) for adaptive wavelet; Fellow of International Optical Engineering (SPIE since 1994) for neural nets; Fellow of INNS (2010) for a founding secretary and treasurer and former president of INNS. Dr Szu has graduated from the Rockefeller University 1971, as thesis student of G. E. Uhlenbeck. He became a visiting member of Institute of Advanced Studies Princeton NJ, as well as a civil servant at NRL, NSWC, ONR, and then a senior scientist at Army Night Vision Electronic Sensory Directorate, Ft. Belvoir VA over 40 years. To pay back the community, he served as research professor at AMU, GWU, and CUA, in Wash DC. Besides 640 publications, over dozen US patents, numerous books & journals (cf. researchgate.net/ profile/Harold_Szu2). Dr. Szu taught thesis students "lesson in creativity: editorial" (for individual with 4C principles and for a group by 10 rules) following a Royal Dutch tradition from Boltzmann, Ehrenfest, & Uhlenbeck (Appl. Opt. 54 Aug. 10, 2015). He has guided over 17 PhD thesis students.