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## HEURISTIC ANALYSIS IN THE PROCESS OF DETECTING SERIAL OFFENDERS, PART TWO - VICTIMOLOGY AND CRIME SCENE RECONSTRUCTION THROUGH THE LENSES OF ABDUCTIVE REASONING

*“Lasciateognisperanza, o voicheentrate”  
Dante Alighieri, La Divina Commedia - canto terzodell’Inferno (1321)*

### 1. Victimology

*“He should have recognized that what really fascinated him was the hunt, the adventure of searching out his victims. And, to a degree, possessing them physically, as one would possess a potted plant, a painting or a Porsche. Owning, as it were, this individual”<sup>1</sup>.*

Those were the words spoken by Ted Bundy to Steven Michaud during interviews that formed the kernel of the book “The only living witness”. Surprisingly, there is quite a lot that can be inferred from above sentence. Firstly, Bundy (albeit speaking in third person) seems to admit to having a *preference* - that is, something that interest him *specifically*. Be it plant or a car, it is a set of characteristics that defines *his* choice of the victim. He would brush off such suggestions with contempt – notwithstanding nearly all of his victims were attractive coeds with their hair parted in the middle. The only exceptions were not exceptions at all – these victims were just to fill the gap when no coeds were available and, in all cases, closely resembled his standard type of victim. Secondly, Ted displays here his pathology of that of sadistic / assertive killer when emphasizing *possession* of the victim, an important element of the fantasy that constituted his pathological drive.

In short, when looking at the victims of the serial crime from the bird view, the targeting and apprehension may look random – it is however (with perhaps exception of a person acting during psychotic episode) quite far from it.

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<sup>1</sup> S. Michaud, H. Aynsworth, *The only living witness* (Second ed.). Authorlink 2012, p. 102.

In bringing up *Satisficing* approach in quite a scientific field of Criminology, which victimology certainly is, we must center our focus on lowest common denominator, that is, the one that will allow for laws of parsimony to work.

So, what is victimology, one may ask? Easiest way to define it would be to say it is the study of crime victims, as well as a study of psychological effects of crimes and interactions between victims and offenders and victims and the criminal justice system.

Forensic victimology is an essential component of crime scene analysis, and therefore an unavoidable feature of any criminal profile. The information gathered from a thorough victimology has the potential to affect each stage of a criminal profile, from crime reconstruction to establishing offender motivation. The goals of forensic victimology include, but are not limited to the following:

- *Assist in understanding elements of the crime.* By studying the victim, the examiner is better able to understand the relationship between a victim and his or her lifestyle and environment, and subsequently of a given offender to that victim. Victimology provides the context for the victim-crime scene interaction, the offender-crime scene interaction, and the victim-offender interaction.
- *Assist in developing a timeline.* Retracing a victim's last known actions and creating a timeline are critical to understanding the victim as a person, understanding the victim's relationship to the environment, understanding the victim's relationship to other events, and understanding how the victim came to be acquired by an offender.
- *Define the suspect pool.* In an unsolved case, where the offender is unknown, a thorough victimology defines the suspect pool. The victim's lifestyle in general and his or her activities in particular must be scrutinized to determine who had access to them, what they had access to, how and when they gained and maintained access, and where the access occurred. If we can understand how and why an offender has selected known victims, then we may also be able to establish a relational link of some kind between the victim and that offender. These links may be geographic, work related, schedule oriented, school related, hobby related, or they may be otherwise connected. The connections provide a suspect pool that includes those with knowledge of, or access to, the related area.
- *Provide investigative suggestions.* A thorough victimology compiled in the investigative stage will offer suggestions and provide direction to the investigation. Such suggestions may include interviewing those in the defined suspect pool, interviewing witnesses about discrepancies in their statements or contradictions with timeline information, and examining any physical evidence that may have been overlooked during the initial investigation.
- *Assist with crime reconstruction.* By understanding the victim's behavior patterns, the examiner is better equipped to complete a thorough crime reconstruction. Knowing why a victim was in the location where he or she was acquired or what the victim was doing in that location will provide the examiner with information

that may be necessary when inferring the most reasonable behavior of that victim.

- *Assist with contextualizing allegations of victimization.* Developing a clear and factually complete victim history will provide context to the allegations of victimization. Victimological information may also support or refute the allegations of victimization.
- *Assist with the development of offender modus operandi.* Knowledge of the victim's pattern of behavior in relation to the location where the victim was acquired may assist with the development of the offender's modus operandi (MO), specifically in victim selection. For example, an offender who is trolling for victims may choose to acquire an opportunistic victim at a location with increased victim availability and vulnerability, such as a busy pub with intoxicated patrons. This information tells us about the offender's MO or the choices made during the commission of the crime.
- *Assist with the development of offender motive.* Without a thorough examination of victim history, the examiner may overlook important victimological information that may reflect the offender's motivation. For example, an examiner can only appropriately establish a list of items missing from a crime scene if it is known what the victim had in his or her possession at the time of victimization. Without this information, a profit-oriented motivation may be disregarded.
- *Assist with establishing the offender's exposure level.* Offender exposure is the general amount of exposure to discovery, identification, or apprehension experienced by the offender. The context surrounding the point at which the offender acquired the victim may assist with establishing the offender's level of exposure. For example, an offender who acquires a victim in broad daylight is at an increased risk of detection and apprehension, which may suggest an increased level of confidence or skill.
- *Assist with case linkage.* When determining whether a series of crimes can be behaviorally linked, victim selection is an important behavioral factor that cannot be ignored during a linkage analysis. A study of the victims across a series of cases may reveal a unique connection between the victims, or the exposure levels of the victims may allow the examiner to support or refute a linkage.
- *Assist with public safety response.* If we can understand how and why offenders have selected their previous victims, then we have a better chance of predicting the type of victim they may select in the future. This will allow the appropriate public safety messages to be delivered to the public with the aim of reducing the exposure levels of those affected individuals. For example, an offender who enters multiple residences through unlocked windows may prompt a public safety message to be delivered to affected communities warning them to lock their windows and doors.

- *Reduce victim deification and vilification.* The objective, scientific, and thorough examination of victims assists in reducing victim deification and vilification<sup>2</sup>.

Modern science defines four theories of victimization. While each of these theories has different positives and negatives, controversies and points of contention, as well as points of accord, each also explains in various situations why a certain individual may be the victim of theft, violence, or abuse.

### **Victim Precipitation Theory**

The victim precipitation theory views victimology from the standpoint that the victims themselves may actually initiate, either passively or actively, the criminal act that ultimately leads to injury or death. During passive precipitation, the victim unconsciously exhibits behaviors or characteristics that instigate or encourage the attack. Siegel (2006) lists job promotions, job status, successes, love interests, and the like as examples of these unconscious behaviors and characteristics. Additionally, political activists, minority groups, those of different sexual orientations, and other individuals pursuing alternate lifestyles may also find themselves as targets of violence due to the inadvertent threat they pose to certain individuals of power. Essentially, the victim precipitation theory focuses on the idea that passive precipitation of violence is a result of a power struggle. A politician may feel threatened by an activist group leader because his action draws attention to negative aspects of his personality and actions that will, or may cause, a loss of power in society. This sort of passive precipitation may also be present when the victim is not even aware of the existence of the attacker. In this instance a new employee may push up the corporate ranks quickly, threatening long-time employees; or a transexual may be the victim of crime due to their existence "threatening" the beliefs and/or ideas of another individual or group of individuals. The latter is a good example of a hate crime, in which victims are often unaware of the individuals that perpetrate the crime, yet their actions and/or characteristics trigger the crime. Active precipitation, on the other hand, is the opposite of the afore-described. Victimization under this theory occurs through the threatening or provocative actions of the victim. One of the most controversial points of this theory is the idea that women who are raped actively contributed in some way, either through provocative dress, a relationship, or suggested consent of intimacy (Siegel, 2006). Because of this viewpoint, it is hard to convict an accused rapist who has had some form of relationship with the victim, or one that was behaving provocatively or suggestively. When dealing with this theory we must ask ourselves whether or not it is really okay to blame the occurrence of a crime on the victim. This is especially true in cases of rape when flirtation may be present, yet there is no consent to sexual intercourse.

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<sup>2</sup> B. Turvey, *Criminal Profiling, An Introduction to Behavioral Evidence Analysis*, Elsevier 2012, pp. 168-169.

### **Lifestyle Theory**

The next theory is the lifestyle theory. This theory purports that individuals are targeted based on their lifestyle choices, and that these lifestyle choices expose them to criminal offenders, and situations in which crimes may be committed. Examples of some lifestyle choices indicated by this theory include going out at night alone, living in "bad" parts of town, associating with known felons, being promiscuous, excessive alcohol use, and doing drugs. In addition to theorizing that victimization is not random, but rather a part of the lifestyle the victims pursues, the lifestyle theory cites research that victims "share personality traits also commonly found in law violators, namely impulsivity and low self control" (Siegel, 2006). This previous statement was discussed in a psychology journal by Jared Dempsey, Gary Fireman, and Eugene Wang, in which they note the correlation between victims and the perpetrators of crimes, both exhibiting impulsive and antisocial-like behaviors (2006). These behaviors may contribute to their victimization since they cause the individual to put themselves at higher risk for victimization than their more conservative lifestyle counterparts.

### **Deviant Place Theory**

The deviant place theory states that greater exposure to dangerous places makes an individual more likely to become the victim of a crime (Siegel, 2006). Unlike the victim precipitation theory, the victims do not influence the crime by actively or passively encouraging it, but rather are victimized as a result of being in "bad" areas. In order to lower the chance that one will become the victim of a crime, the individual should avoid the "bad" areas of town where crime rates are high. For example, South Central Los Angeles is notorious for its gangs, and high crime rate. The more an individual ventures into South Central, the more likely they are to become the victim of a crime there. Sociologist William Julius Wilson discusses the social and economic inequality that finds more minorities in the victim seat, since minorities are more commonly from low income households that are unable to move away from crime-ridden areas than their caucasian peers are (1990). Moreover, the deviant place theory suggests that taking safety precautions in these areas may be of little use since it is the neighborhood, and not the lifestyle choices, that affect victimization (Siegel, 2006). In a nutshell, if a neighborhood is "deviant," the only way to lower your risk of victimization is to leave the neighborhood for a less deviant, low crime rate area.

### **Routine Activity Theory**

Lastly, the routine activity theory explains the rate of victimization through a set of situations that reflect the routines of typical individuals.

1. The availability of suitable targets,

2. The absence of capable guardians, and
3. The presence of motivated offenders.

According to this theory, the presence of one or more of these factors creates a higher risk of victimization. For example, leaving one's home during vacation creates a suitable target. Leaving a home for vacation in an urban area creates an even greater risk; and leaving one's home on vacation in an urban area in which there is a high number of teenage boys, known felons, or other "motivated offenders" creates an even higher risk for victimization. Communities with ample police protection, alarms and other security devices, and community watch teams, lower their risk by creating guardianship, which is noted under this theory to reduce crime rates. Empirical evidence for this theory is seen in the work of Cohen and Felson, who noted that the crimes rates from 1960 to 1980 increased due to a decreased presence in the home (i.e less guardianship) (Siegel, 2006). We can also look at practical, everyday examples, such as those of affluent neighborhoods. These neighborhoods have low crime rates, despite the availability of goods. This may be attributed to the high guardianship in the form of security systems, and a lack of motivated offenders<sup>3</sup>.

Let's then try to apply above theories to Bundy's crime profile, shall we? His victims being predominantly attractive coeds with hair parted in the middle, were mostly apprehended by means of ruse in form of Ted pretending to be a student, with his arm in a cast fumbling with books he was carrying, or impersonating police officer – therefore these cases would fall under Routine Activity Theory. These low-risk victims (as per FBI's dichotomy) *perceived* their level of safety as quite high. What could possibly happen to the law abiding, hardworking, conscientious student? Yet, quite a few coeds were snatched from public spaces (campuses, school theatre) and we can see now how presence of suitable subjects, lack of capable guardians and loitering of a very motivated offender, resulted in successful kidnapping of next victim.

*Before we progress further, it must be noted that with above reasoning, virtually all solved serial crime cases victims could be easily defined by means of these four theorems (theorems because the whole concept of theorem is it being deductive, while theory is purely empirical). This is an important statement, as it will serve as a reference point in our try to compile and apply an Artificial Intelligence (AI), Deep Neural Network (DNN) algorithm in the supervised learning process. Known, solved cases will allow for verification of the neural network algorithm training, where it will be possible to define iteration error and its decrease in the course of AI learning. This, in turn, will allow us to use the trained algorithm on data contained in the unsolved cases databases (e.g., ViCLAS).*

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<sup>3</sup> J. Dempsey, G. Fireman, E. Wang, *Transitioning Out of Peer Victimization in School Children: Gender and Behavioral Characteristics*. Journal of Psychopathology and Behavioral Assessment 28, 2006, pp. 271 - 280.

## 2. Crime Scene Analysis – abductive reasoning

Our search for presence of signature relies solely on crime scene reconstruction. This is because reconstruction focuses on gathering, examination and interpretation of psychological evidence, witness or living victim statements as well as confessions of apprehended suspect. In a nutshell, these are the tangible elements of the crime scene. The actions of an offender during the commission of the crime, and in the post-offense interval, directly influence the nature and quality of evidence that is left behind. The actions can include precautionary acts, ritual or fantasy, and staging – all what defines the signature<sup>4</sup>. Thus, offender's ephemeral emotions can't be seen with a naked eye and must be inferred through the deductive reasoning of a skilled investigator. We can therefore state, in view of the above, that success of deductive reasoning will be directly affected by the quality of the gathered evidence as well as talent / experience of the investigator. This may not be enough with lot of required linkage analysis – simply put, there is a limit to human cognition, which when crossed, will make successful reasoning impossible. It is easy to imagine that successful inference will require for the investigator to find the evidence of criminal skill and also to understand knowledge of the crime scene by the offender and his relationship with the victim (stranger / not a stranger). In serial cases, amount of required data processing will likely be way too large for even the best of the investigators to work on.

Renowned forensic psychologist Richard Kocsis PhD, goes much further with his critique of criminal profiling which analysis of the crime scene is part of, when he writes that the technique of criminal profiling has proliferated over recent decades, despite a remarkable lack of empirically rigorous evidence concerning its accuracy. Notwithstanding the absence of evidence, the very circumstance of the continued use of profiles by police investigators is often regarded as proof of their accuracy. This phenomenon is essentially informed by an “operational utilitarian argument.” Namely, anecdotal evaluations of criminal profiles sponsor their continued use<sup>5</sup>.

With *satisficing* approach, AI can help with algorithms that are utilizing abductive reasoning, where it starts with a set of observations and then it is looking for most likely conclusion from the observations.

Let's have a quick look at this form of reasoning and how can we use it in our work.

Abductive reasoning allows inferring  $\alpha$  as an explanation of  $\beta$ . As a result of this inference, abduction allows the precondition  $\alpha$  to be abducted from the consequence  $\beta$ . (When you look at someone fingertips and they are yellow you may come to the conclusion that this person is a smoker. It is a form of abductive reasoning because yellow fingertips can also indicate psoriasis, skin damage due to action of certain chemicals or just hue of yellow paint remaining on the skin surface – being smoker is simply put, the best plausible explanation).

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<sup>4</sup> T. Brent, *Criminal Profiling, An Introduction to Behavioral Evidence Analysis*, Elsevier, 2012, p. 268.

<sup>5</sup> N. Kocsis Richard, *Criminal Profiling, Principles and Practice*, Humana Press, 2006, p. 36.

One of the well-known abduction models is that of Konolige's and is contained in two definitions:

**Definition 1.1** *Let  $L$  be a first order language. A simple causal theory is a tuple  $\{C, E, \Sigma\}$  where:*

1.  $C$ , a set of sentences of  $L$ , are the causes;
2.  $E$ , a set of sentences of  $L$ , are the effects;
3.  $\Sigma$ , a set of sentences of  $L$ , is the domain theory.

**Definition 1.2** *Let  $\{C, E, \Sigma\}$  be a simple causal theory. An explanation of a set of observations  $O$  subset  $E$  is a finite set  $A$  subset  $C$  such that:*

1.  $A$  is consistent with  $\Sigma$ ;
2.  $\Sigma \cup A \vdash O$ ;
3.  $A$  is subset-minimal over sets satisfying the first two conditions, i.e., there is no proper subset of  $A$  consistent with  $\Sigma$  that implies  $O$ .

Bylander and his colleagues offer a similar definition:

**Definition 1.3** *An abduction problem is a tuple  $\{Dall, Hall, e, pl\}$  where:*

1.  $Dall$  is a finite set of all the data to be explained;
2.  $Hall$  is a finite set of all the individual hypotheses;
3.  $e$  is a map from all subsets of  $Hall$  to subsets of  $Dall$ ;
4.  $pl$  is a map from subsets of  $Hall$  to a partially ordered set representing the plausibility of various hypotheses.

A set of hypotheses  $H$  is an *explanation* if it is complete and parsimonious, i.e., if  $e(H) = Dall$ , and no proper subset of  $H$  explains all the data that  $H$  does.

The similarities between these two sets of definitions are obvious. Konolige's causes correspond to Bylander hypotheses; Konolige's effects correspond to Bylander's data. Konolige's requirement that a set of causes be subset-minimal is identical as Bylander's requirement that a set of hypotheses be *parsimonious*. Bylander goes beyond Konolige in requiring an explanation to explain all the data and in adding a plausibility ordering on hypotheses. On the other hand, their definition is more general than Konolige's in not restricting data and hypotheses to sentences.

These definitions nicely capture what is central in abductive reasoning, which is the goal of assembling a set of hypotheses (causes) that provide good explanations of the data (effects). But each of them oversimplifies abductive reasoning in several important respects<sup>6</sup>.

The definitions of Konolige and Bylander have the unfortunate implication that abduction is *always* a matter of selection from a known set of hypotheses or caus-

<sup>6</sup> P. Thagard, C. Shelley, *Abductive reasoning: Logic, visual thinking, and coherence*, Philosophy Department, University of Waterloo, Ontario, 1997, N2L 3G1.



es. However, it is important for us to understand that in an argument to the above definitions, abduction can be creative and sometimes indeed revolutionary!

Perhaps most known (or heard of) example of abductive reasoning is published in 1905 Albert Einstein's *Special Relativity Theory*, where famous equation which describes interchangeability of energy and mass ( $E=mc^2$ ) stems from. This theory explains how space and time are linked for any object that is moving with constant speed at a straight line and why speed of light in a vacuum is a universal speed limit<sup>7</sup>. Creation of this theory involved leap of imagination so profound and significant, that physical observations that were available at the beginning of twentieth century would simply not be sufficient. Thus, large part of the work was completed through the "thought experiment" –which caused Einstein work to be promptly discredited by some of his peers. Needless to say Einstein was right at least until now – prime example being communication satellites, which could not be operated without understanding and solving the problem of the time dilation, that forms fundamental part of the *Special Relativity Theory*.

Therefore, in the words of Thagard's and Shelley, completeness is elusive, while simplicity is complex. All the above points in to direction of AI implementation in to process of detecting serial offenders.

Here, in the artificial intelligence algorithm, the abduction will be used in *belief revision*, that is in the process of changing beliefs in order to accommodate a new piece of information. This is fundamental in creation of *rational agent* – which in our case would be an algorithm which takes actions autonomously in order to improve performance with learning (defined by the decrease of iterative error).

### 3. Artificial Intelligence based Neural Networks – an introduction

Artificial Intelligence is nothing more than displayed by the machine intelligence (in our case the ability to learn) as opposed to natural intelligence, displayed by humans and animals. In short, study of above-mentioned rational agents, that change in order to achieve their goals.

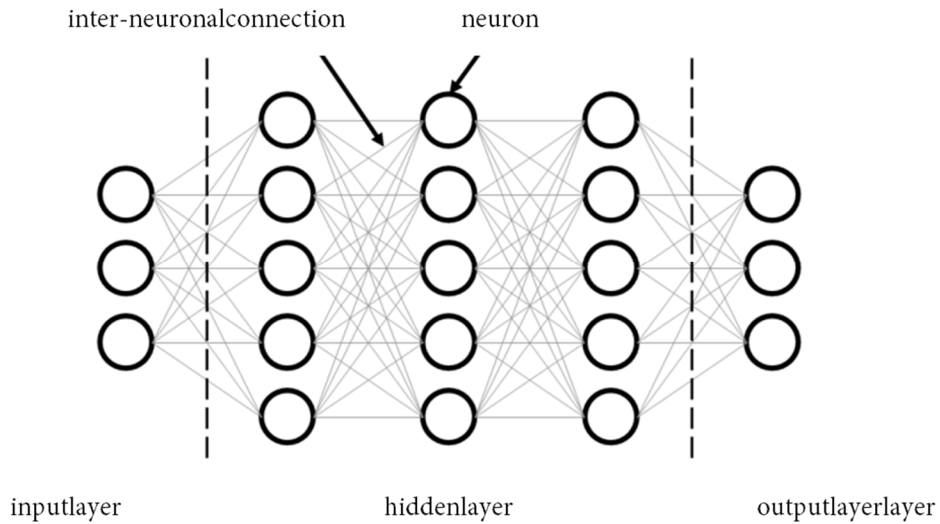
The learning process utilizing neural networks (Fig.1) is inspired by the function of human neurons (Fig. 2). A single neuron has  $n$ - number of entry connections, where  $n$  denotes number of neurons whose information has a *bearing*. All the connections in the network have applied weights, which are subject to change in the learning process. Each neuron receives multiple signals: in form of the input data or - for the hidden layers - the outputs of the neurons from the previous layer (Fig. 3).

Each neuron entry layer is defined by the output neurons of the previous layer multiplied by the connection weight. Therefore, neuron returns single value at the output, which is one of many inputs in the next layer. Weighted sum of all entries is then used as an argument for computation of an input value based on activating function. The main

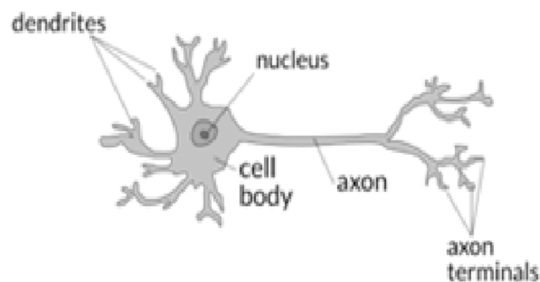
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<sup>7</sup> A. Einstein, *Relativity: The Special and General Theory*, 1920.

task of the activation function is therefore to augment positive correlation and to block transfer of poorly correlated information. In doing so, activation function decides when neuron is to fire, thus defining output of the node given and input or set of inputs.

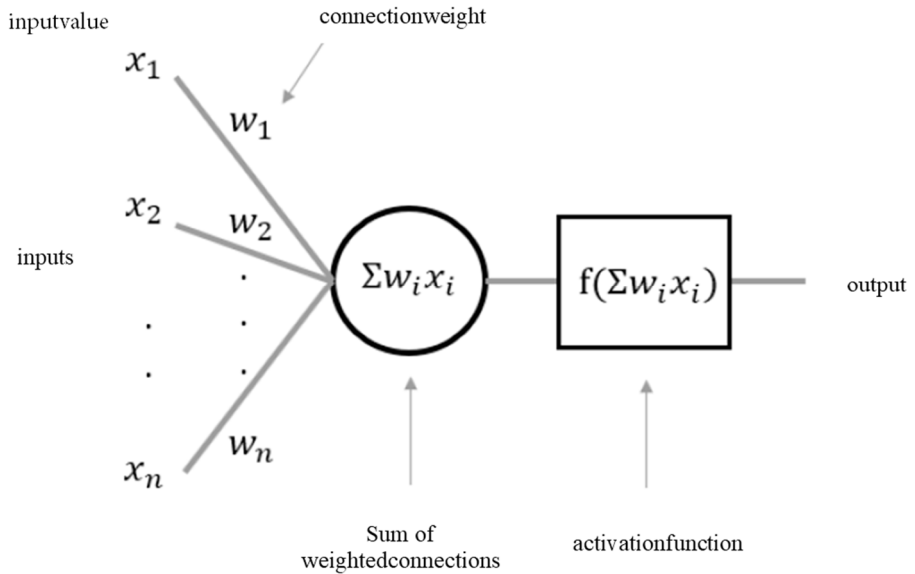


**Fig. 1 General schematics of artificial neural network (McCulloch – Pitt's based)**



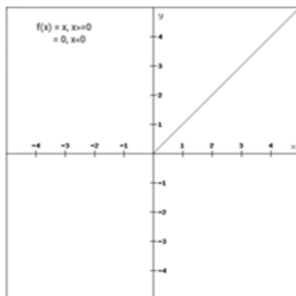
**Fig.2 General schematics of a human neuron<sup>8</sup>**

<sup>8</sup> D. Gupta, *Fundamentals of Deep Learning – Activation Functions and When to Use Them?*, 2020, <https://www.analyticsvidhya.com/blog/2020/01/fundamentals-deep-learning-activation-functions-when-to-use-them/> (accessed 04.08.2021).

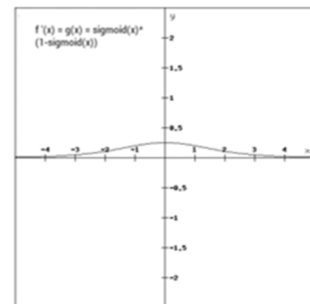


**Fig.3 General schematics of artificial neuron (McCulloch – Pitt’s based)**

There is a number of activation functions, each with its own limitations and best use. For instance linear regression of rectified linear unit, ReLU ( $f(x)=\max(0, x)$ ) fares better than non-linear Sigmoid ( $f(x)=1/(1+e^{-x})$ ) like functions, when better convergence performance is required. If you look at the negative side of the graph, you will notice that the gradient value is zero. Therefore, the ReLU function is not susceptible to the vanishing gradient problem, where the activations are computed to lie in the "flat" area of the gradient curve, yielding no progress in the training process.



**Fig.4 Gradient of the ReLU function<sup>9</sup>**

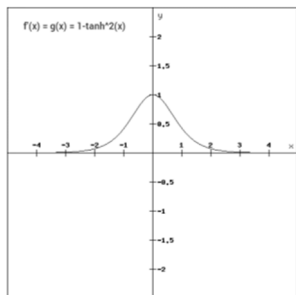


**Fig.5 Gradient of the sigmoid function<sup>10</sup>**

<sup>9</sup> Ibidem.

<sup>10</sup> Ibidem.

Also, for instance, tangential activation function ( $\tanh(x)=2\text{sigmoid}(2x)-1$ ), will



cause, if weighted sum will be negative, for return value to be close to -1. If weighted sum is positive, the return value will be close to 1. Negative input value will therefore cause for an algorithm to find it as a poor correlation between signals and analogically for positive values as a value returned by the previous neuron. Usually *tanh* is preferred over the *sigmoid* function since it is zero centered and the gradients are not restricted to move in a certain direction (Fig.5).

**Fig.5 Gradient of the tan h function<sup>11</sup>**

All the above leads to rather clear conclusion of *supervised learning* having a great plasticity, which in our cause will be useful to have, as perhaps for a first time we will be able to ‘transplant’ the mathematical algorithm in to social science frame of reference. With *satisficing* approach to the signature of the unsub, victimology and crime scene reconstruction, it will be possible to generate an algorithm that, based on a training data, should be able to learn to the extent required for statistically valid prognosis of the unsolved, serial crime. It must be noted that an average human brain consists of approximately 86 billion neurons – basic artificial network cycle is usually built on only 100 to 200 neurons, which is well enough to ‘cook’ a single, modern personal computer processor!

Application of the AI in the detection of the unsub signature will be the aim of the next article.

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<sup>11</sup> Ibidem.

Włodzimierz Markiewicz

### **Heuristic analysis in the process of detecting serial offenders, part two - Victimology and Crime Scene Reconstruction through the lenses of Abductive Reasoning**

In the article, victimology, from the point of view of *satisficing* is defined. Utilization of the abductive reasoning in analysis of crime scene is explained. Here, the cognitive limits related to criminal profiling are determined. The article is the second in a series of publications describing the use of computer aided heuristic analysis in the process of detecting perpetrators of serial crime (ViCLAS). Using the Konolidge's and Bylander's definitions, abductive reasoning is explained. The paper introduces reader to basics of an AI neural network and its potential of use in above mentioned process. Author presents engagement of the abductive reasoning in to process supervised learning.

**Keywords:** Victimology, victim theory, crime scene reconstruction, Konolidge's abductive reasoning, AI, supervised learning process, neural network, activation function.

### **Analiza heurystyczna w procesie wykrywania przestępców seryjnych, części druga - wiktymologia oraz rekonstrukcja miejsca przestępstwa w świetle rozumowania abdukcyjnego**

W artykule zdefiniowano wiktymologię z punktu widzenia *satisficing*. Wyjaśniono wykorzystanie rozumowania abdukcyjnego w analizie miejsca przestępstwa. Określono tutaj limity poznawcze związane z profilowaniem przestępców. Artykuł jest drugim w serii publikacji opisujących zastosowanie komputerowej analizy heurystycznej w procesie wykrywania sprawców przestępstw seryjnych (ViCLAS). Korzystając z definicji Konolidge'a i Biglander'a, wyjaśniono rozumowanie abdukcyjne. W artykule, czytelnikowi przedstawione zostają podstawy sieci neuronowej i jej potencjał stosowania w wyżej wymienionym procesie. Autor przedstawia również zastosowanie rozumowania abdukcyjnego w procesie uczenia nadzorowanego.

**Słowa kluczowe:** wiktymologia, teoria ofiary, rekonstrukcja sceny przestępstwa, rozumowanie abdukcyjne (Konolidge et al.), SI, proces uczenia nadzorowanego, sieć neuronowa, funkcja aktywacji.

*Translated by Włodzimierz Markiewicz*

