



**УНИВЕРСИТЕТ ЗА НАЦИОНАЛНО И СВЕТОВНО**  
**СТОПАНСТВО**

**The future of Criminal Profiling:**  
**VICOCO**

***Автори:***

Виктория Филипова, Ф№ 293257

Гергана Иванова, Ф№ 293268

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# 1. Artificial Intelligence (AI)

Artificial intelligence (or AI) is both the intelligence of machines and the branch of computer science which aims to create it, through "the study and design of intelligent agents" or "rational agents", where an intelligent agent is a system that perceives its environment and takes actions which maximize its chances of success. Achievements in artificial intelligence include constrained and well-defined problems such as games, crossword-solving and optical character recognition.

A simple definition does exist: "the science and engineering of making intelligent machines." (John McCarthy-coined the term in 1956).

AI research is also divided by several technical issues. There are subfields which are focused on the solution of specific problems, on one of several possible approaches, on the use of widely differing tools and towards the accomplishment of particular applications. The central problems of AI include such traits as reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects. General intelligence (or "strong AI") is still among the field's long term goals. Currently popular approaches include statistical methods, computational intelligence and traditional symbolic AI. There are an enormous number of tools used in AI, including versions of search and mathematical optimization, logic, methods based on probability and economics, and many others.

Among the traits that researchers hope machines will exhibit are reasoning, knowledge, planning, learning, communication, perception, and the ability to move and manipulate objects.

Artificial General Intelligence (AGI) describes research that aims to create machines capable of general intelligent action.

Most researchers think that their work will eventually be incorporated into a machine with *general* intelligence (known as strong AI), combining all the skills above and exceeding human abilities at most or all of them. A few believe that anthropomorphic features like artificial consciousness or an artificial brain may be required for such a project.

Many of the problems above are considered AI-complete: to solve one problem, you must solve them all. For example, even a straightforward, specific task like machine translation requires that the machine follow the author's argument (reason), know what is being talked

about (knowledge), and faithfully reproduce the author's intention (social intelligence). Machine translation, therefore, is believed to be AI-complete: it may require strong AI to be done as well as humans can do it.

Artificial intelligence (AI) involves the study of cognitive phenomena in machines. One of the practical goals of AI is to implement aspects of human intelligence in computers. Computers are also widely used as a tool with which to study cognitive phenomena. Computational modeling uses simulations to study how human intelligence may be structured. The study of **cognitive science** includes research on intelligence and behavior, especially focusing on how information is represented, processed, and transformed (in faculties such as perception, language, memory, reasoning, and emotion) within nervous systems (human or other animal) and machines (e.g. computers).

**The four main approaches to AI:**

What is AGI?	Thinking	Acting
humanly	Cognitive Science	Turing Test, Behaviorism
rationality	Laws of thought	Doing the “right” thing

*(Marcus Hutter - Universal Artificial Intelligence - Singularity Summit Australia 2012)*

**The difference between humanly and rationality agents:**

Within artificial intelligence, a **rational agent** is one that maximizes its expected *utility*, given its current knowledge. Utility is the usefulness of the consequences of its actions. The utility function is arbitrarily defined by the designer, but should be a function of *performance*, which is the directly measurable consequences, such as winning or losing money.

In order to make a safe agent that plays defensively, a nonlinear function of performance is often desired, so that the reward for winning is lower than the punishment for losing. An agent might be rational within its own problem area, but finding the rational decision for

arbitrarily complex problems is not practically possible. The rationality of human thought is a key problem in the psychology of reasoning.

### ***Acting humanly: The Turing Test approach***

Turing defined intelligent behavior as the ability to achieve human-level performance in all cognitive tasks, sufficient to fool an interrogator. Roughly speaking, the test he proposed is that the computer should be interrogated by a human via a teletype, and passes the test if the interrogator cannot tell if there is a computer or a human at the other end.

For now, programming a computer to pass the test provides plenty to work on. The computer would need to possess the following capabilities:

- **natural language processing** to enable it to communicate successfully in English (or some other human language);
- **knowledge representation** to store information provided before or during the interrogation;
- **automated reasoning** to use the stored information to answer questions and to draw new conclusions;
- **machine learning** to adapt to new circumstances and to detect and extrapolate patterns.

Turing's test deliberately avoided direct physical interaction between the interrogator and the computer, because *physical* simulation of a person is unnecessary for intelligence. However, the so-called **total Turing Test** includes a video signal so that the interrogator can test the subject's perceptual abilities, as well as the opportunity for the interrogator to pass physical objects "through the hatch." To pass the total Turing Test, the computer will need

- **computer vision** to perceive objects, and
- **robotics** to move them about.

### ***Thinking humanly: The cognitive modelling approach***

If we are going to say that a given program thinks like a human, we must have some way of determining how humans think. We need to get *inside* the actual workings of human minds. There are two ways to do this: through introspection--trying to catch our own thoughts as they

go by--or through psychological experiments. Once we have a sufficiently precise theory of the mind, it becomes possible to express the theory as a computer program. If the program's input/output and timing behavior matches human behavior, that is evidence that some of the program's mechanisms may also be operating in humans.

***Thinking rationally: The laws of thought approach***

These laws of thought were supposed to govern the operation of the mind, and initiated the field of **logic**.

***Acting rationally: The rational agent approach***

Acting rationally means acting so as to achieve one's goals, given one's beliefs. An **agent** is just something that perceives and acts. In this approach, AI is viewed as the study and construction of rational agents.

Generally, building a humanly based system is one of the biggest challenges.

**What is self-improved intelligence?**

Self-improvement causes systems to allocate their physical and computational resources according to a universal principle. It also causes systems to exhibit four natural drives:

1) Efficiency, 2) self-preservation, 3) resource acquisition, and 4) creativity.

Unbridled, these drives lead to both desirable and undesirable behaviors. The efficiency drive leads to algorithm optimization, data compression, atomically precise physical structures, reversible computation, adiabatic physical action, and the virtualization of the physical. It also governs a system's choice of memories, theorems, language, and logic. The self-preservation drive leads to defensive strategies such as "energy encryption" for hiding resources and promotes replication and game theoretic modeling. The resource acquisition drive leads to a variety of competitive behaviors and promotes rapid physical expansion and imperialism. The creativity drive leads to the development of new concepts, algorithms, theorems, devices, and processes. The best of these traits could usher in a new era of peace and prosperity; the worst are characteristic of human psychopaths and could bring widespread destruction

## 2. Criminal Profiler

Criminal profilers help solve crimes by giving law enforcement officers an idea of how criminals think and why they commit certain crimes. The job of a profiler includes reviewing evidence, determining the processes used by criminals during a crime, making an assessment about a crime based on the evidence reviewed, writing reports that are used by police to find perpetrators and testifying in court.

Also they have to find out how the killers are killing and why.

In a sense, a profiler is very much like a modern-day Sherlock Holmes, though they rely far more on deductive reasoning, hard facts and accepted principles. Criminal profilers take into consideration important details, such as: The manner in which crimes were committed; The location of crimes; The choice of victims; The type of crimes; The timing of crimes; Any communications from the suspect; The condition of the crime scenes; Making profile of the killer;

### **What is profiling?**

Criminal profiling is the act of developing a psychological profile of an offender based on the state of the crime scene. Profiling is most often done by a forensic psychologist -- someone who has studied the criminal mind. This profile can then be used by police departments to assist in apprehending the criminal.

A profile is a psychological sketch of an offender. There is a lot that a crime scene can tell a forensic psychologist about the person who committed the crime. This is especially true in homicide investigations. Criminal profiling is often used to help investigators catch psychopaths and serial killers that may otherwise go free. It can also be used to help catch other types of offenders, such as arsonists and rapists.

In criminal profiling, a crime scene helps to label the perpetrator as organized, disorganized, or mixed. An organized offender plans ahead, picking out the victim ahead of time. Any tools needed are brought by the offender. He is meticulous with details, and it is clear that the crime was.

### 3. Concept and purpose

VIDOCQ is a project, aimed at helping or replacing criminal profilers. The name of the machine derives from Eugène François Vidocq, who was founder of the French Police department, considered to be the first private detective and also father of modern criminology.

VIDOCQ is a self-improving artificial intelligence computer invention. As it was already noted in section 1 of this paper – AI has two variations. The humanly concept and the rational concept. They define the behavior of the machine and exactly how it will work. VIDOCQ functions under the humanly concept, because its work is connected to the human mind, which rarely behaves under laws and rules.

Being created under the humanly concept means that VIDOCQ will be using the cognitive science foundations in its thinking process, rather than the laws and thought and logic. It also means that it will be acting according to the Turing test and the laws of behaviorism, rather than it will be acting according to the Turing test and the laws of behaviorism, rather than simply doing the “right” thing.

The purpose of VIDOCQ is to help police investigations against serial killers and to a certain extent to replace human profilers or aid them as much as possible. The project is aimed to assist human activity, not eliminate it completely. It is so, because an AI cannot foretell human feelings and emotions, as accurate as it is, because people, and especially the ones in question, can never be as predictable as necessary.

Serial killers behave and act in a certain pattern of actions, but their feelings, emotions and thoughts are not necessarily as predictable. This is why human activity is also highly recommended in the process of creating someone’s profile.

VIDOCQ is created for usage by police agencies all over the world, such as FBI, CSI, etc. The matter of its functionality is better explained in section 4

## 4. How it works?

VIDOCQ is to be created as a self-improving machine, meaning in its first stage of use it will have a database of its own and will improve from there on. The database will contain psychological terms, meanings, diagnosis, illnesses, examples, etc. The primary information would have to be basic, but thorough, as it is will be derived from text books in the field of psychology.

Also, the data base will include a history of past serial killer cases. They must be thoroughly explained, alongside with the criminal's profile, created by a human profiler. It is important to include not only the solved and closed cases, in which the given profile was correct, but also the open cases, where the profiler was either wrong or such a criminal (fitting the profile) was never caught. Because having both right and wrong examples would give another solid beginning base to VIDOCQ.

Being self-improved also requires VIDOCQ to have constant access to internet and enough capacity and capability to be aware of the information it needs to download and implement in its work.

The working process of VIDOCQ can be divided into three main steps:

1. Input data
2. Profile creation
3. Profile matching (if possible) or prediction of future actions (with a certain percentage of accuracy and human assistance)

The first step, data input, involves synthesizing the available information for past events and inputting into the system. Then VIDOCQ can start an analysis and reach step 2. In order to create a profile of the prosecutor, the computer must have all necessary information at its disposal. Such as number of victims, place of murder, victim characteristics, method of killing, etc. This is highly important for creating or recognizing a pattern that the murderer supposedly follows. The killing method, which is being established in the process, involves choosing the victims, places and times for the murder. But not only. A background search of the victims is also highly recommended, because it might help in the establishment of a motive for that specific choice of a person.

Once VIDOCQ can figure out all those connections – the killing pattern is already figured out. That would account to half of the criminal profile. The other half is a psycho-analysis on the basis of the gathered information. It needs to be conducted, taking into account the input data that is available for the committed crimes and the recognized action pattern. For this analysis, the motives are very valuable. If they have not been established in the pattern – they must be established at this phase of the process. And that is exactly the necessity of a human involvement in the process. VIDOCQ can judge a behavior based on previously gathered knowledge, but not on emotions, as it does not possess any. Being able to “get into the mind” of the criminal is very important, because a profile is not just a killing pattern and its reasons, but it also has to do with his feelings, emotions and beliefs. It is not rare that serial killers are delusional or followers of a sect, but that data may or may not have been already input into VIDOCQ, leading to it not being able to make an accurate enough profile on its own, thus leading to the human assistance of the process.

At this point, the criminal’s profile is already built and can be implemented into the police system, along with all the previously gathered information.

Step 3 requires a connection between VIDOCQ and the police database of suspects. Also, being connected to the Internet makes easier a connection to social networks as well, which is highly recommended. It is so, because the criminal in question may or may not possess a criminal record, meaning he is or is not in the police database, leaving the process with a 50% chance of finding him according to his already built profile. Most serial killers are usually “clean” up until they become what they are, so finding them in the database would be impossible, as they are not there. This is when a connection to social networks all over the world would be of great help, as VIDOCQ can match the profile to the information in people’s profiles. Physical appearance matching is not part of this process, as it would be very misleading in such a huge world-wide database.

Conducting such a search is mandatory, but could result in nothing. This is why step three is either this process or a prediction. Both can also be applied, for greater results, but one of two is good enough for an easier prosecution of an unknown serial killer suspect.

A prediction is built by VIDOCQ based upon the information it already had in the beginning of the process, the pattern it established and the profile that was developed as a final result, in collaboration with a human. Predictions are prognosis, not a plan, so they have

a certain percentage of accuracy. VIDOCQ is created to raise that percentage, that could have been achieved by a human profiler only.

Some serial killers leave encoded messages for police officers, as well as clues, ciphers, cryptograms, etc. It usually takes a long time to figure them out, time that the killer has to plan his next murder and, possibly, conduct it. VIDOCQ is designed to ease that activity as well. Being a self-improving machine with constant internet connection, it can search and discover patterns and codes much faster than humans, leading to a quicker code breaking, which can sometimes (often) be a turning point in an investigation.

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