

Title: The Profiling Potential of Computer Vision and the Challenge of Computation

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Introduction

The term "Profiling" allows a variety of meanings to illustrate its use with the context at hand. For this paper, the term has been defined as the automated evaluation of certain traits about a person, simultaneously reminding us of the legal significance of "classification" even without subsequent discrimination. The paper address three main categories throughout its writeup. They are profiling, profiling knowledge claims and the effect of law in the computer vision field. The paper introduces few important definitions to familiarize the reader with terminologies that would be used multiple times throughout the paper itself.

The knowledge claims represent the core of the paper. It talks about ways of gathering information or knowledge from the real world and then understanding it.

Computer Vision Profiling

Personality analysis has been a sought-out adventure by many scientists and engineers since the 1990s. Two prominent types of such analysis are the Apparent Personality Analysis and the Apparent Personality Recognition. Personality computation makes use of faces, postures, gestures, emotions, interactions, and actions to interpolate personality traits. Some try to achieve this by using static information like how a person looks, while some implement multiple modalities like combining information from visual data and audio data with different configurations. Below is a visual example to align the perspective of inferences that would be made when addressing profiling of personality and its variations.

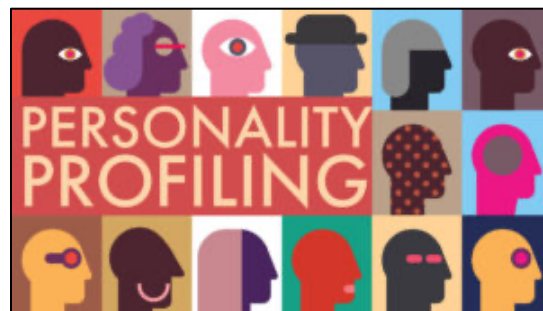


Figure 1. Personality Profiling.

(Is Personality Profiling at Work Helpful Or Harmful? - Tandem HR, 2020)

To explain Personality Analysis, two assumptions have been made in this paper. One is when there is a stable statistical relationship between stimuli and social personality while the other is with a true personality characteristic. The former pertains to APA and the latter pertains to APR.

Computational Personality Analysis

The goals of both these analysis types explore multiple stimuli, from dynamic facial information, handwriting and even audio, that is speech. This exploration brings light to a type of study called Computational Physiognomy.

The early representation of this study was using a simple machine learning practice by implementing models using Euclidean distances, thus straight-line measurements. Varying angles of triangles were used to classify facial features. This was made possible due to the division of the face into 32 classes, which was pioneered by Johann Kasper Lavator. This process eventually allowed the introduction of convoluted deep neural networks. It brought about advancement to the analysis of personality by predicting intelligence and other personality characteristics based on the image.

To illustrate such advancement in personality analysis, an example of the project of Wu and Zhang's paper, the Automated inference on Criminality Using Face Images, was used. Half of the dataset contained images of subjects that were criminally convicted. The results of this project were not able to differentiate the differences between a criminal and a non-criminal. However, the research established an understanding of the requirements and the depth of computation that could be necessary to interpolate such a difference. According to the text, "Only through the higher dimensional computational analysis of numerical quantitative measurements was this statistical separation discernible." (Goldenfein 113)

Computational Empiricism

According to the paper, photography is a way to 'see into nature's cabinet' (Goldenfein 114). To illustrate this characteristic, examples like using the telescope for celestial objects or using the microscope to identify cellular objects were used.

Data is another way of being able to visualize information about an image. In computer vision, the constant and repeated measurements, encoding and decoding, and knowledge discovery are automated. A heavyweight is usually given to the initial process of clustering where the system is allowed to identify representations of groups of data, calling this process 'feature creation'.

Computer vision systems measure visual data to determine the current or the previous state of the world. This is the mathematical bridge between technology and the physical world. According to the paper, "computer vision profiling is about noticing, measuring and analyzing that which was previously not available to human perception and cognition". (Goldenfein 114) For the system to be able to depict the information from the real world, the 3-dimensional data of the real world is reduced to 2-dimensional data set of measurements. Here, Goldenfein cleverly brings out the uncertainty of the reality of a data set being unable to accurately represent the 3-dimensional state. Taking account of the other dimension, which can't be accurately interpolated, the probability is used to define the best possibility of the state of the world at that point. To tackle the challenge of immense data being utilized, computer systems take in symbolic representations, which is essentially clustering of data into groups representing one unit. Representation learning takes place when the process of clustering is allowed on the dataset being read in. Further deep learning practices take place that allows the system to understand and learn automatically thereby discover representations needed for detection or classification.

Computational Empiricism as a Dominant Epistemology

This area broadly identifies the forms of computational empiricism applied to understand people as subjects. They are divided into three elemental structures:

1. External measurement or observation is more reliable to knowledge or information than the symbolic output from subjects. To illustrate this, the paper takes the example of a stethoscope where the practice of ‘auscultation’ bore fruit. It is the process of listening to the body at a physical distance. According to Goldenfein “stethoscopes have been invoked to demonstrate the movement from theoretical to perceptual ways of knowing the body.”
2. A type of computational intervention in the relationship between measurement and classification. This brings light to the decisions and choices about what attributes of measurement in each layer of representation within the neural network. This, primarily, talks about the system having its mind to understand the data that has been given to it for processing.
3. Blind yet knowledgeable belief that there is more to see than what meets the eye. In other words, the system is exposing the fundamental substructures of the reality of that instance of the world state, to which we are entitled. Goldenfein says that this belief is “a metaphysical commitment to a world of truth”.

Law with the World State

Given that the current systems act like a “screen”, it does not necessarily expose the underlying truth that we seek instead, it puts forth a filter under which the ‘real’ or ‘genuine’ slowly decays. This is how digital profiling works. This type of profiling is used as “proxies for defining characteristics about us.” Thus, there is a substantial amount of rectification of data of individuals, or subjects, to help maintain the ‘borderlines of meaning’ about themselves.

To address the issues occurring with digital profiling, there have been many different legal approaches. One is the improvement of automated systems, which is reaching close to a ‘fairer’ computation of the real world and the subject. Thus, limiting the bias factor exponentially. However, this brings in the question of ‘ruling and governance’ within a society, where “grievances with society’s institutions can be reframed as questions of algorithmic accountability.” (Goldenfein 116)

The next is the legal challenges that are being presented to overachieving data science applications. Usually, these have a negative or a harmful impact on society. Thus, it narrows down to “defending the fundamental dignity and opacity of persons”. With subjects being exposed to digital profiling, there is also an area for consent that allows whether the subject wishes to be part of this. Alongside the thoroughness of the access and rectification rights and the fundamental principles of processing in Article 5, Article 22 allows subjects to be either willing or against the mechanism of profiling. To meet a sweet spot of consent and getting profiled, Hildebrandt focuses on “Right to human non-computability built on the philosophical principle of indeterminate identity”(Goldenfein 117). This does not imply diving down to prehistoric times of privacy but instead allows a to limit certain classes of knowledge claims.

Conclusion

The paper has done a good job showcasing the challenges for image analysis and brought about deterministic structure to identify the uniqueness in algorithmic computation. The insight of computational empiricism with data processing and understanding the personalities still has a lot to be worked on. Not only by law, but there are unique computational challenges that need to be addressed, especially when it comes to hidden layers within a neural network.

Lawmakers have good work laid out in front of them where the philosophy of measuring everything and drawing knowledge from those measurements is the path to truth. In this paper, we realize that critiquing data science, that is the algorithms, and its feedback system means exposing the difference between the real or physical world and the 'world state'. Thereby challenging the idea of systems accessing the 'hidden reality' of the world than producing para-realities.

One improvement that could make this paper better is the inclusion of some visual representations like graphs and statistics. This could illustrate the core profiling methods and the challenges being faced in the computer vision field. It would have been a good idea to illustrate the comparison and the similarities with photographs and statistics in a visual manner to make Goldenfein's reason that much more evident than just mentioning it in the literature.

Works Cited:

Jake Goldenfein. 2019. The Profiling Potential of Computer Vision and the Challenge of Computational Empiricism. In Proceedings of the Conference on Fairness, Accountability, and Transparency (FAT* '19). Association for Computing Machinery, New York, NY, USA, 110–119. DOI: <https://doi.org/10.1145/3287560.3287568>

Is Personality Profiling At Work Helpful Or Harmful? - Tandem HR. (2020, July 18). Tandem HR. <https://tandemhr.com/personality-profiling-at-work/>