Artificial Life Intelligence for Individual and Societal Accomplishment

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Abstract— **This paper explores the potential of the rapidly evolving fields of Natural Language Processing and Affective Computing and proposes future applications that combine the power of both fields to assist individuals in their personal and collective accomplishment. It studies the latest developments in the field of Emotion Detection and Recognition from facial expression, voice and text and discusses the shortcomings in current analysis systems. Human subjectivity is key to every choice, decision and act of individuals, and a comprehensive knowledge of human psychology is essential for effective analysis. As Emotional AI transcends the physical parameters and moves closer to understanding the emotional and mental human being in future, and Deep Learning enables greater comprehension of unstructured textual and audio-visual data, Cognitive Computing can employ big data processing to assist humans in acquiring scholarship, anticipating social trends and even understanding life. The paper concludes with a proposal for a revolutionary field of Artificial Life Intelligence that can promote universal human welfare.**

Keywords— *Affective Computing, Emotional AI, Natural Language Processing, Natural Language Understanding, Big Data Processing, Pattern Recognition, Human Psychology, Principles of Accomplishment, Social Evolution, Character of Life*

I. Introduction

Data powered Artificial Intelligence (AI) and Cognitive Computing (CC) are pervasive and promise to exercise an increasing impact on every aspect of our lives. High profile applications of AI and CC include IBM Deep Blue defeating chess Grandmaster Garry Kasparov, NASA's robotic exploration rovers, Google's autonomous cars, Amazon's customization based on user preferences, and voice enabled personal assistants such as Siri and Alexa. At the same time, AI and CC are quietly powering up our daily lives, becoming an essential part of our communication, travel, shopping, banking and finance, surveillance and security, governance, journalism, art and entertainment.

CC promises to free humans from repetitive, laborious, mechanical work, so we can focus on more creative and inspiring activities. It takes over dangerous and difficult tasks from us, processes large quantities of data that is not possible for us to handle, and it individualizes and customizes our learning, gaming, buying and various other needs. According to Gartner, 25% of customer service operations will use virtual customer assistants by 2020[1]. Accenture Research predicts that by the same time, 77% of banks plan to use AI to automate tasks to a large or very large extent[2]. The global healthcare AI market is expected to grow at a CAGR of 51.9% between 2018 and 2023.

[1] Gartner Press Release, February 19, 2018, Tokyo, Japan

[2] Realizing the full value of AI in banking
https://www.accenture.com/us-en/insights/banking/future-workforce-banking-survey

In 2017, the market was valued at USD 1003.3 million and is expected to appreciate to USD 12,218.3 million by the end of 2023. AI has made possible self-checkout in Amazon's retail store Amazon Go. An AI lawyer chatbot dubbed as "the world's first robot lawyer" that provides free and fast legal aid in minor legal issues has successfully contested over 160,000 parking tickets in London and New York at no cost to its users. Finnish software and services company Tieto has an AI system in a senior management position with voting rights. Schools in Tampere, Finland are experimenting successfully with humanoid robot teachers.

Apart from the rising efficiency that results from the trends listed above, another commonality is the decreasing human interaction in our activities. Such lack of human emotions and subjectivity in our lives is raising numerous questions about the merit of AI and leading to the evolution of Artificial Emotional Intelligence, or Emotional AI.

II. Emotional AI

Emotions have been the key to the survival of Homo sapiens and their nearest ancestors, says Jonathan H. Turner, Professor of Sociology at the University of California, Riverside[1]. Emotions not only make us human, define our relationships and add value to our lives, they are essential for our very survival as a species. The value of our subjective emotional experience has always been recognized, if not awarded equal status and legitimacy as scientifically proven objective data. Back in 1964, a simulation of a Rogerian psychotherapist was developed by Joseph Weizenbaum, computer scientist and former Professor at MIT. This early therapist chatbot provided human-like interaction within a limited knowledge base. However, it was not until Rosalind Picard's 1997 book *Affective Computing* that the field of Emotional AI developed as a significant branch of AI and CC [2]. Picard studied the significance of human emotions in intelligence and the impact of emotion recognition in machines. Recognizing human emotions, processing them and customizing the AI system in response to the emotions add value to the AI service, increase corporate profit, and serve an altruistic purpose as well. In addition, when CC can understand human psychology, value systems and subjectivity, it can better understand the human being and positively contribute to our future. A mechanistic, objective AI may lead to a dystopian state. "Without explicit goals to the contrary, AIs are likely to behave like human sociopaths in their pursuit of resources," according to computer scientist Stephen M. Omohundro. When positive human values are incorporated in CC, these same machines are transformed into systems that simulate, though not feel human-like emotions[3].

Emotional AI identifies emotions in three main ways: Facial expression recognition, Voice intonation analysis and Biometric reading. Deep learning is used to process inputs from these sources to identify human emotions. More

accurately, Emotional AI identifies and categorizes the physical manifestation of an emotion. The smile or frown on the face is recognized, the cheerfulness or depression in the tone of voice identified, the pulse rate and body temperature measured. Emotional AI processes this data and determines how the person feels. Nascent though this field is, it has found applications in market research, political campaigns, governance, psychological counselling and product design among others. The Affective Computing industry is estimated to grow to $41 billion by 2022[4].

The British government monitors citizens' sentiments regarding certain issues on social media. AI therapists and coaches aim to alleviate mental health concerns by using behavioural therapy techniques through conversational user interfaces. AI product Ellie targets soldiers with Post-Traumatic Stress Disorder, Karim is meant to assist traumatized Syrian refugees. Many digital assistants and tech wearables work to alleviate stress, loneliness and any negative emotions in people. The IBM Watson Tone Analyzer enables businesses to build chatbots that detect customer tones and build dialogue strategies that adjust the chatbot's conversation accordingly. Qihan Technology's Sanbot and SoftBank Robotics' Pepper train their personal assistant robots to react differently to different human emotions. The AI sales lab in Haaga-Helia University of Applied Sciences, Helsinki reads prospective buyers' facial expressions and provides feedback about the emotions they are experiencing, so that salespersons can adapt their sales pitch to suit customers' requirements. Sentiment analysis platform Senno generates business intelligence analytics using blockchain technology. Affective Computing company Affectiva is partnering with Ford to embed sentiment analysis software in cars and trucks. This detects the driver's physical and mental state – anger, frustration, anxiety, fatigue, drowsiness – and intervenes, even taking control of the vehicle. This is expected to prevent accidents and instances of road rage, and improve road safety.

III. COMPLEXITY OF HUMAN SUBJECTIVITY

By 2022, one's personal devices will know more about one's emotional state than one's own family, according to Annette Zimmermann[1], Research Vice President at Gartner. Basically, what is emotion? According to psychologist and former Professor at the University of Amsterdam Nico Fridja, emotions can be regarded as being composed of five parts[5]:

- an appraisal of a perceived situation,
- a qualitative sensation,
- some kind of psychophysiological arousal,
- an expressive component (facial, gestural, etc.), and
- a behavioral disposition or bias (i.e. psychological parameter setting or a readiness for an appropriate kind of action)

Can CC have fully understood any or all of these components of emotion by 2022? Is it even possible to understand it ever? Emotional AI uses the physical manifestation of emotion to detect it. But facial expression of

[1] L. Goasduff, "Emotion AI Will Personalize Interactions Gartner" January 22, 2018
https://www.gartner.com/smarterwithgartner/emotion-ai-will-personalize-interactions/

an emotion is not the emotion itself. One does not express all that one feels. In some cases, the expression may be different from the actual emotion felt. Expressions can differ from culture to culture, from person to person. One needs to know another well enough to truly understand their feelings, facial expressions are but one clue. So how far can detection of a facial expression or tone be used to automate objective measurement of people's emotions and "understand" them?

Research literature primarily defines seven distinct facial expressions of emotions[6]: anger, disgust, fear, happiness, sadness, surprise and contempt. But human emotions are varied and nuanced, and do not lend themselves to be either classified into a few broad categories or quantified and digitized. Simplistic as it is to create an emoticon to represent Mona Lisa's smile, placing irrational, emotional and evolving human beings into broad categories based on their facial expressions is more so. Almost all our thoughts, feelings, attitudes, choices, decisions and acts are influenced by our subjectivity. The hidden universes within the human mind are not completely or perfectly understood even by the greatest of psychologists. Emotional AI and CC scientists have now achieved the ability to detect physical expressions of emotions and to an extent, classify, process and simulate emotion in return. But the intricacies of human psychology necessitate the development of far more subtle, powerful and holistic CC capacities in future.

IV. NATURAL LANGUAGE PROCESSING: CHALLENGES AND OPPORTUNITIES

Due to development in machine learning algorithms that replaced complex hand written rules in the 1980s, the computational power of Natural Language Processing (NLP) and Natural Language Understanding (NLU) systems has significantly increased. NLP can recognize entities, parse grammar, tag parts of speech, perform advanced string manipulation, translate and summarize documents. Advanced NLP and NLU systems perform logical inference, topic modelling, relationship detection, graphical representation, document similarity comparison, document classification, sentiment analysis, and emotion detection and recognition. Even audio conversations can be analyzed to extract insights using tools such as Google Cloud Speech API. Processing vast repositories of text, speech to text and text to speech conversion, and real time translation of text and audio are some features that will simplify a lot of our work, make possible what was earlier unfeasible, and create great opportunities in education, business, governance and every area of human welfare. In 2018, Alibaba's language processing AI outperformed humans at a Stanford University reading and comprehension test, scoring 82.44 against 82.304 on a set of 100,000 questions[7]. The exam was based on information from over 500 Wikipedia articles, from which the AI was successfully able to infer answers to objective questions. This is where the strength of current NLP systems lies: objectivity. Subjectivity however poses a challenge.

Written language is often an art. It is subjective, nuanced, and can contain more between the lines. Context is vital to understanding intent. One's culture, family, upbringing, aspirations, and the prevailing social, economic and political climate of the time influence one's thoughts and words. Be it fiction, biography, historical narrative, personal letter, political propaganda or marketing material, human subjectivity and emotions are an integral part of the text. How is NLP today equipped to handle this? Google Cloud Natural

Language, for example, can recognize entities and label them by type, such as person, product, organization, event or location. It can extract information about these entities from the text. Thus far, it proves fairly accurate. Then it attempts sentiment analysis to understand the overall sentiment expressed. It extracts statements from the text and assigns them a score on a scale that ranges from negative through neutral to positive. In addition, it estimates the sentiment significance of each statement. A quick trial of its sentiment analysis API shows that this system is still at a rudimentary level. It has a long way to go before it can detect the significance of Desdemona dropping her handkerchief in *Othello* or the nobility of Sydney Carton in changing places with Charles Darnay in *A Tale of Two Cities*. Today NLP can process Charles Dickens' *David Copperfield* and come up with the entities David, Micawber, Agnes, London, Salem House School and King's Bench prison. It can identify the first three as proper nouns, London as the capital of England, and the last two as a school and a prison respectively. But it cannot gauge the tragicomedy of Micawber's imprisonment, Agnes' constant and silent love for David, the miserable schools that could hurt children more than they educated them, or the changing landscape of England during the Industrial Revolution. This, however, is the ultimate aim of NLP and NLU, to follow common-sense reasoning, understand human psychology and recognize individuals' value systems.

V. ARTIFICIAL LIFE INTELLIGENCE

Affective Computing, NLP and CC certainly have almost infinite room for improvement, but human ingenuity too has infinite potential for the task. We have seen AI move from e-mail spam filters that categorize text based on its content, to virtual assistants that provide templated responses, to free-form debaters that appear to meaningfully engage in debates on complex topics and answer open-ended questions. We see continuous advancement in language translation capacities. Big data processing is being effectively put to a variety of uses. One surprising application of data analysis has been detecting teachers who cheat during examinations[8]. Affective Computing is becoming more comprehensive and accurate. It will eventually move beyond the physical expressions of emotion, and understand the basic rules of human psychology and subjectivity. This will require collaborative, multilevel, trans-disciplinary research and design by human experts from all fields. Every principle of human psychology learnt, all the quirks and idiosyncrasies of people, and all the manifestations of human subjectivity will need to be codified. Moreover, this knowledge base must be updated on an ongoing basis as individuals and societies evolve. So such a CC system must have a symbiotic relationship with humans. No system however advanced can be truly effective in understanding or handling humans if it functions autonomously, basing itself solely on a set of codified rules. Even if it does not lead to a dystopian future where machines rule the world, such an autonomous system can soon become irrelevant to humans. On the other hand, a symbiotic system combining the powers of advanced Affective Computing, NLP, NLU, Big data and Deep Learning can lead to the development of a revolutionary science: Artificial Life Intelligence (ALI) that can assist us in acquiring scholarship, understanding people and societies, and improving the quality of life!

Scholarship begins with the assimilation of facts. While the average reading speed for humans is 200 to 250 words per minute, that does not take into account comprehension and is not indicative of how much we remember later. Out of these three limitations – speed, memory and comprehension – the first two do not apply to ALI. It can process massive amounts of textual and audio-visual data spanning human history, politics, management, biography, and literature. This opens up whole new fields for research in the social sciences and humanities.

Take the case of biographies and autobiographies. When we read the life stories of great men and women, we may become inspired, we may be able to draw lessons from their lives, and identify personality traits that helped them achieve. After studying many such people over time we may be able to detect a pattern. Many or all of these leaders will be seen to have some common characteristics – courage, strength, integrity, perseverance and so on. One or few of these characteristics are prominent in each – we remember Shakespeare for his language, Beethoven for his musical talent, Lincoln for his honesty, Gandhi for his non-violence, Churchill for his strength, and Gorbachev for his far-sighted and selfless politics. With intensive study and careful analysis, we may be able to make a list of striking characteristics of great leaders in an attempt to understand leadership. If an ALI system is introduced in such an endeavour, it becomes possible to launch the study on a far larger scale. The ALI system can process biographies, autobiographies, speeches, historical texts, audio and video recordings of thousands of high achievers over time, and summarize its findings for us. The system will certainly have its limitations. It may or may not be able to discern subtleties of character. It may interpret the intent of words and expressions incorrectly. It may not be able to differentiate between the many shades of human emotions and values. It cannot tell with accuracy if a certain act is out of courage, bravado, foolhardiness or stupidity. It cannot come up with a comprehensive science and art of leadership. But it can process massive quantities of data in all modes and languages. It can identify commonalities and anomalies, it can detect patterns not possible for one individual to do. Its objectivity leaves no room for partiality or prejudice. Using the ALI generated research findings, we can then take over and extract the quintessence of leadership.

Such a symbiotic relationship between ALI and humans that combines the powerful processing capacities of the computer with human intuition, perception and creativity has great potential and opens up infinite opportunities. It can help us accomplish more than we can otherwise do individually. Not only leadership, similar studies can be carried out to identify various other personality traits as well - what creates geniuses, artists, sportspeople, musicians, original thinkers? ALI will be able to analyse the complex array of subjective psychological elements such as personal behaviours, attitudes, characteristics, and values, and help us find answer to these and other profound questions such as how do leaders emerge just when a crisis threatens society, how do they convert challenges into opportunities, and why some initiatives succeed while others fail.

The same methodology that can help understand personality traits can be extended to gain mastery over any field. Challenging tasks such as visualizing a concept that emerges on collating data from multiple sources and connecting them in different dimensions can be simplified by ALI that can process nearly any amount of multi-dimensional data and represent it visually as a graphic. There are instances

where scholars have devoted their entire lives to the study of one specific field. Grammarian and lexicographer H.W. Fowler spent all his life studying the English language and became a lexicographical genius. Historian Arnold Toynbee dedicated his life to the study of history, and published his 12-volume *A Study in History* over twenty seven years. Such authoritative research requires an investment of a tremendous amount of time, access to resources, painstaking effort, original thought and inspiration. ALI can assist us by collecting data, translating, sorting, categorizing, topic modelling and summarizing. As robotics is helping humans with repetitive and hard physical work, ALI can assist us with mental effort.

In addition to research and scholarship, ALI assisted study of historical events and social movements can serve other purposes as well. Strange coincidences such as similarities in the lives of Lincoln and Kennedy, people separated by World War II in Europe meeting in America after the war or identical events happening in the lives of twins simultaneously have been discovered by resourceful people. But such findings are intended more to entertain and amuse, they are hardly taken seriously by most. Historians and social scientists study different social movements and revolutions and compare and contrast them. Insights are drawn from these studies, but a powerful ALI assisted multi-dimensional study of the psychological and subjective factors associated with each physical act or series of acts in history can detect patterns and cyclical movements in societies around the world. They may provide clues to many of our questions like: How does human aspiration determine development? Why did some civilizations prosper? What results in the decline of civilizations? What is common to all our revolutions? What led to the rise of dictatorships? What causes war? Where may a war erupt next and how can we prevent it? Can we anticipate economic booms and busts? ALI and big data processing can reveal the path of social evolution and its future trajectory. They can help us detect cyclical historical movements, understand current social conditions, anticipate future trends, get prepared to handle them successfully and consciously steer social evolution. The symbiotic system of ALI that combines the power of computing with research in the humanities brings about the much needed integration of the arts and sciences. Our knowledge is so fragmented and specialized that we are no longer able to see the whole. ALI can enable us to put the pieces back together so we can discover knowledge in the overabundantly available data.

A database waiting to be benefited from is literature. Great literature is always true to life. Consciously or unconsciously writers capture the essence of the social, cultural, moral, economic, and political conditions of the place and period in which the story is set. Literature offers insight into the subjective aspect of life that compliments the objective facts of history and sociology textbooks. For instance, slavery can be understood better when seen through the eyes of Tom in the Harriet Beecher Stowe novel *Uncle Tom's Cabin*. When the publication of the book is connected to a public outcry against slavery in USA that sparks off the Civil War, we begin to see interconnections. When the same connections are made between various books and movements–Anna Sewell's *Black Beauty* and the introduction of legislation to protect animals in England; Gene Sharp's writings on democracy and nonviolent action and the Arab Spring– we realize the power of literature to start a revolution! With big data processing, ALI can make it easier for us to identify many such interconnections. The timeless wisdom of humanity is captured in our literature. It is subtly hidden in every page of every book – in the dialogue, in the action, in the coincidences, and in the correlations between an individual's internal thoughts and external life events. ALI can help us discover these truths.

One such truth is that societies that are more inclusive avoid violent upheavals. Specifically, England let go of its class consciousness and thereby avoided its own version of the French Revolution. Is it possible for a reader of Jane Austen's Pride and Prejudice to see that the landed gentleman Fitzwilliam Darcy marrying Elizabeth Bennet who is from a lower social stratum of English society is a manifestation of this peaceful social evolution in England? It requires the perception of a genius to see that Darcy and the English aristocrats married across class distinctions and thus saved their heads, and that Jane Austen has captured this social movement in her story. For most, the synchronicity of the revolution raging across the channel, the publication of Jane Austen's novel and the peaceful transition in English society is not self-evident. ALI can supplement our efforts here. With its superprocessing power, it can alert us to similarities, synchronicities, vagaries, and patterns in literature that may point to corresponding phenomena in real life. The system may not know what it is looking for or understand what it has found. It is we who need to ask the right questions and make the right inferences. But when we do that, it can lead us to new frontiers of knowledge.

Such study can be extended beyond literature, to encompass all available subjects. A multi-dimensional research covering literature, biography, psychology, history, politics, business management, and current affairs using all available textual and audio-visual data and the power of ALI can give rise to a science that does not exist yet! It is possible that when every recorded detail of every event in the world is studied, many startling answers are revealed. How human aspiration has always been the source of all human energy, why energy is essential to any accomplishment, and how human thoughts, feelings, attitudes and values are correlated to external life events may be established. When taken individually, what seem to be random events to us may, when seen in large volumes, reveal startling patterns. No bullet ever struck Churchill or Washington. Both were courageous men. Does fear attract the object feared, and courage repel it? The sudden appearance of a fog at Dunkirk during evacuation of the British forces during World War II, and when George Washington and his soldiers crossed the East river during the American War of Independence altered the course of history. Were they chance events, is nature really inanimate, does it cooperate with human aspiration and societal evolution? Napoleon and others have observed that subjective factors can be equivalent to three times the numerical strength of an enemy in military operations. To what extent did Franklin D Roosevelt's declaration that *there is nothing to fear but fear itself*, and Churchill's categorical declaration that *we shall never surrender* to the Nazis contribute to quell public fear or instil courage and determination? How far do subjective factors influence our lives? ALI can be used to weed out superstitions, rectify incorrect concepts, and identify, test and validate the role of fundamental life principles and characteristics that have until now been accessible only by acute personal study.

If our vision can be compared to the view of the territory around while standing on plain land, the perspective obtained from big data is like the view from a mountain peak. Links that may otherwise be missed and correlations that may not be detected by an individual human mind can become visible. ALI can even give us answers to questions we do not have. It may decode the causality of life. Of course, human intervention and supervision will always be needed, but ALI can power the process that understands data and interprets it creatively. Using the system generated outputs, the ultimate decision making must be in the hands of competent and qualified people. After all, the airline captain Chesley "Sully" Sullenberger landed his aircraft safely in the Hudson River disregarding intelligence instructions. He realized that the computer simulation did not factor in human values or emotions. He refused to consider the cost of the aircraft and saved all 155 people on board. Human discretion and choice will need to be paramount for a safe and healthy future. As Erik Brynjolfsson, Director of the MIT Initiative on the Digital Economy, says, *"Technology creates possibilities and potential, but ultimately, the future we get will depend on the choices we make."*

VI. CONCLUSION

Humans are always pushing the frontiers of what is possible. That which is not manifest is not unmanifestable. With Affective Computing, Natural Language Understanding, Big data processing and Cognitive Computing improving at a rapid pace and promising to pervade every aspect of human existence, this revolutionary science of Artificial Life Intelligence has the potential to, with its broad long-range perspective and astronomic processing power, help us identify personality traits, acquire scholarship, discover the art and science of accomplishment, consciously aid social evolution, extract ageless wisdom concealed in our literature, and decode the very character of life.

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