

Emotional Machines

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"The question is not whether intelligent machines have any emotions, but whether machines can be intelligent without any emotions."
Marvin Minsky, 1985

"A computer is a machine, which can manipulate data by executing instructions, given as programs." This is the general definition of a computer emphasizing Turing machine and stored program concept, as known to all. This definition clearly states that, computer is just a "worker" – it needs "clear and concise" command about what to do and how to do. Once we command as it expect, we get exactly what we instruct. Now the question is what we want it to do in future.

We want our workers to do their job quickly and correctly and not to contradict us. A computer is ideal in this respect. Moreover, computer doesn't "suffer" from humanly needs like stiffness, monotony, hunger, pain and so on, which makes it a better option in some fields. Thus, from the point of view of a master-slave relationship, it is a benefit over human workers that computers do whatever it is instructed.

But, as human we have intelligence which computers do not have. So the question arises... Can we build a computer that mimics Human-like Intelligence? This is an ill posed question as we actually do not have any definition of intelligence. But we know - human can observe, understand, perceive, explain and thereby think and act intelligently, and we want similar behavior from computer also, i.e we want to build the Intelligent Machine. Research was going on this topic even before birth of digital computers. Nowadays, though Artificial Intelligence (AI) has become an integrated part of computer science, we still have so many definitions and so many approaches and philosophies for it.

Some researchers want it human-like (more abstract), taking into account that human is the ultimate source of intelligence and to be intelligent - a machine should think or act like a human. On the other hand, other researchers describe intelligent as being rational. Their point is - An intelligent agent doesn't need to think what a human could do in an adverse situation; rather it should do something that maximizes its performance measure or objective function. Such AI is termed "Weak AI".

Though we can do a lot with so called Weak AI or "Applied AI", one of the ultimate goals of AI study is to develop "Strong AI" or Artificial General Intelligence, intelligence that matches or

exceeds human intelligence—the intelligence of a machine that can successfully perform any intellectual task that a human being can. Now the question is how to get to that sort of AI.

A lot of tools have been developed, to mimic intelligence, some of them being influenced by human brain functionality and some taking advantage of heuristic functions, complex mathematics, logic and probability. Logical inference, Symbolic logic, Knowledge base, Probabilistic reasoning, Search techniques, Natural language processing, Motion manipulation, Classification and machine learning, Pattern recognition all are essential for the success, but none of these actually mimics human mind or emotion or activity.

This is where “Affective Computing” starts its flight. Affective computing is the field dealing with the problem of recognizing, interpreting, and processing human emotions. Rosalind Picard's 1995 seminal paper formally introduces this interdisciplinary subject spanning Computer Science, Cognitive Science and Psychology. One may ask, how far can we go with simulating human mind or human emotions. But recent research in neuroscience and psychology has established the fact that, human intelligence is a blend of logic and emotion. Human are more driven by emotions than by rational thinking. And general human ability, creativity and arts are deep rooted into the several emotion states a human mind can have. Unless we incorporate emotion into the machine, we can't get that sort of artistic and intellectual output from computer. The belief is that – to generate something “beautiful”, the computer needs to understand what beauty is. Thus “Empathy” – the capacity to recognize or understand another's state of mind or emotion is one of the preliminary goals of Affective Computing. Marvin Minsky, one of the pioneering researchers in AI and Cognitive Science, relates emotions to the broader issues of machine intelligence in his book “The Emotion Machine” stating that emotion is not especially different from the processes we call 'thinking'.

But answers to some basic questions in emotion theory such as: "What are emotions?", "Why do we have emotions?" and "What causes emotions?" are not known yet. Numerous theories have been proposed, as researchers have tried to understand how emotions are generated, expressed and recognized. Researchers of one side say that emotions are caused by physiological changes such as the increased heart rate or increased or decreased circulation of blood in brain that accompanies anger, excitement, joy or sadness. Researchers at the other extreme see emotions as purely cognitive, merely another form of thought.

But today we know that both brain and body interact in the generation of emotion. According to Gelernter, emotions are tightly linked with bodily states, which feed it. This means that, one doesn't think just with the brain, but with both brain and body. And this “cognitive unity” also renders that the idea – “mind is to brain as program is to computer”, is weak. All emotions can't be explained by thoughts, but some occur without obvious cognitive evaluation, may be by changes in bodily chemistry also. Thus evolution of affective computers requires understanding of both the physical and cognitive parts of emotion.

One may ask what the gain is by making computers intelligent and emotional like human. Do we need our computers to compose music for us? Or by any chance, does anyone dream to enjoy “Computer Generated Synthetic Tagore songs” or “Synthetic Beethoven” or “Synthetic Picasso”? Whether there is any need for such service from computer is a matter of debate, actually there are still many applications of human-like intelligence in computers. In fact, we never can stop the quest of researchers, who dream to make programs more and more intelligent and realistic!!

Due to technological advancement and easy availability of mobile or embedded systems, use of information technology and computing devices is becoming more and more ubiquitous. Computers are now assisting human in a more close-knit fashion than ever before. We have wearable, plantable, injectable and similar other computers, which along with appropriate communication technology is going to weave the whole world and mankind into a single connected network ensuring global connectivity, consciousness, security and safety for everyone. In this new era of pervasive computing, it is better to have the softwares behave in a more humanly fashion. Isn't it a nice feature if the software tailors its user interface dynamically according to the present mental state of the user, or gives understandable explanations and descriptions tailored for the user? A home control computer can automatically change the air, temperature and humidity depending on the people there at that time and their “emotions”. Even more, how nice is it, if my computer itself can select “appropriate songs” for me depending on the situation? On the other hand, we may want to search videos and audios for specific scenes and specific themes, only pattern recognition mathematics can't help here actually, some humanly intelligence is needed. Thus application of humanly intelligence is endless; we just need to discover the proper automation options.

AI is one of the most promising fields of Computer Science. AI dreams to take our computers one level up, addressing the toughest problems which are not easily solvable by direct algorithmic procedure. We believe that human creativity and intelligence is virtually endless. Incorporating emotions via Affective computing gives AI a new light and shows us new horizon. Thus we find some hope that in future our computers may stand at least beside us in solving problems and taking “humanly” decisions.