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ARTIFICIAL INTELLIGENCE EDUCATION: EMOTIONAL COMPUTATION

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ABSTRACT
Following decades of research into artificial intelligence, several researchers are now attempting to build emotionally intelligent machines. The capacity of a computer to "think or behave humanly or rationally" is the traditional concept of artificial intelligence (Russell, 1995). The drive for emotionally intelligent machines is an exciting development in this area, moving us closer to machines that genuinely "act human." I will include a survey of topics and tools for teaching emotional computation in artificial intelligence courses in this post. This subject field, I will demonstrate, is an excellent application of modern artificial intelligence techniques and a significant aspect of current AI research. The interdisciplinary nature of work in this space is convincing not only in the classroom, but it can also contribute to increased interest in the field of Computer Science.

1. INTRODUCTION
Many experts in the fields of artificial intelligence and human-computer interaction have predicted that potential computers or intelligent agents would need to communicate with their users on an emotional level (Norman, 2004). This is founded on the idea that a smart and successful person can not only think mathematically, verbally, and logically, but also communicate with others. Most of the recent research in this field has focused on giving agents the ability to perceive and convey emotion through expression and gestures using verbal, nonverbal, and textual cues. In this post, I'll show why and how this subject can be included in introductory artificial intelligence classes, as well as provide proof of this trend toward systems with emotional intelligence.

2. EMOTIONAL INTELLIGENCE
The The term "emotional intelligence" became popular in the late 1980s, although Thorndike had explored a related idea called "mental intelligence" years earlier, in 1920. (Thorndike, 1920). Although social intelligence is usually described as one's "ability to understand and control other people, as well as participate in adaptive social interactions" (Kihlstrom, 2000), Emotional intelligence refers to one's capacity to recognize, understand, manipulate, and convey emotion in one's own life and in interactions with others (Salovey, 1990). Knowing one's feelings, controlling emotions, empowering oneself, understanding emotions in others, and handling relationships are the five areas that Salovey and Mayer describe as essential to emotional intelligence. The EQ (emotional intelligence quotient), which can be measured using a variety of readily available EQ measures, is a standard measure of Emotional Intelligence.

Many AI and HCI researchers started to take the concept of emotion and emotional intelligence seriously in the late 1990s. Rosalind Picard created the Affective Computing Lab at the MIT Media Lab in 1997, following the publication of her book "Affective Computing," in which she set out the basis for creating computers with emotional intelligence (Picard, 1997). Picard, like many other scientists working in this field, has developed computers that can sense, manage, recognize, and communicate emotions.

Before delving into the ideas and implementations of emotionally intelligent robots, it's crucial to recognize that empathy is an integral feature of intelligence. This study is necessitated by data from a few separate areas. Prior to moving into the work that has been done in constructing machines that are emotionally intelligent, I will include references to some of this documentation.

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Is the term "emotional intelligence" a misnomer? Emotions have been viewed as disorganized interruptions of mental activity in one Western tradition, and as such, they must be controlled.

Salovey and Mayer, 1990

The general belief is that emotion is a barrier to intelligent thinking, as Salovey and Mayer express in the quote above. Many research in the area of Affective Neuroscience has shown that this is not the case, and that it is, in reality, the opposite. The study of how the brain processes emotions is known as affective neuroscience. Emotion is important in problem solving and other cognitive activities in the brain, according to researchers in this area (Damasio, 1994). Aside from the scientific data derived from Affective Neuroscience, several publications from mainstream psychology have supported this notion, suggesting that emotional sophistication is essential to a person's performance in a variety of areas (Gardner, 1993; Goleman, 1997).

Models of Emotion

To comprehend efforts in this area, one must first comprehend the various emotional models that are integrated into programs. What aspects of emotion can be gleaned from the available feedback signal, what model lends itself best to internal logic within a system, and what kind of emotional communication the system seeks to achieve are all factors that influence the model chosen.

The most basic model is that of valence (positive or negative) and intensity, in which opinion is expressed as a single score ranging from -1 to +1, with -1 denoting the most extreme negativity and +1 denoting the most intense positivity. The dimension of domination is added to a much more complicated model (a scale from submissive to dominant). The speed factor of this model is referred to as "arousal" (a scale from calm to excited). The VAD model, which stands for valence, arousal, and domination (or PAD if valence is replaced by the synonym "pleasure"), is a more nuanced model (Bradley, 1999; Mehrabian, 1996). Since these measurements lend themselves well to this role, this model is widely used to measure emotional responses in humans.

Ekman's six emotions model – pleasure, sorrow, rage, anxiety, surprise, and disgust – is a more well-known model (Ekman 2003). This six-dimensional model is designed to characterize expressive facial expressions and is often used in applications that aim to convey emotion during user interaction. A mapping occurs between the VAD and Ekman models to aid in the development of structures that can both sense and convey emotion. In the Ekman model, a low valence, high arousal, and low dominance VAD score corresponds to anxiety, while a low valence, high arousal, and high dominance VAD score corresponds to frustration (Liu, 2003).

Emotional Intelligence of Machines

With a clear need for research in this field, I can now present the ways in which scientists are working to create emotionally intelligent machines. Emotional intelligence is described in a variety of ways, but it all boils down to the ability to communicate with others by sensing, expressing, controlling, and recognizing one's own and others' emotions. Empowering the machine to sense emotion, enabling the machine to convey emotion, and finally, embodying the machine in a virtual or physical way are all key components of creating emotionally intelligent machines. Projects incorporating both of these elements often necessitate the need to manage and sustain an interpersonal relationship with a person, which adds a significant level of difficulty. In the parts that follow, I'll show you how programs handle these challenges, with the aim of exposing students to practice in the field of emotional intelligence.

Detecting Emotion

Many different inputs have been studied in the area of artificial approaches to sensing emotion, including verbal cues, non-verbal cues such as movements and facial expressions, bodily signals such as skin conductivity, and textual knowledge. The end goal of developing applications that can sense a user's emotional reaction is to handle/understand the response and respond appropriately – a challenge that is broader and less known than merely detecting emotional responses/expression in the first place.

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Many current testing technologies can be used in a classroom environment to demonstrate this principle, including systems that detect emotion in speech (Polzin, 1998; Yu 2001), facial expressions and movements (Gunes 2005), bodily signals (Strauss, 2005), and text (Strauss, 2005). (Pang, 2002; Turney 2003). Though there are several projects in this area, I usually incorporate the concept of emotion detection in my AI course by introducing my own work in this area, detecting emotion in text (Owsley, 2006; Sood, 2007). This thesis is well-suited to an AI course because it employs a number of strategies that are commonly learned in AI courses.

RTS (Reasoning By Search) is a machine learning algorithm that classifies a piece of text using the valence/intensity model of emotion. Other systems based on the other models of emotion mentioned in the previous section have been created, but this one was restricted to the seemingly simple task of ranking a set of text on a scale from -1 to +1. (extremely negative to extremely positive). The system was trained using 106,000 movie and product reviews as truth info, with star ratings (from 1 to 5) serving as the basis.

Because of the differences in the emotional connotations of certain terms across domains/contexts, a strictly statistical approach performs poorly for the task at hand. When describing a politician, the word "cold" has a negative connotation, while "cold" when describing a beverage has a positive connotation. To avoid the effects of averaging, a case-based approach is more suitable for building a “general” (not domain specific) emotional classifier. The RTS method incorporates the advantages of the Nave Bayes Model, Case Based Reasoning, and multiple information retrieval techniques. On the valence/intensity model, the end system classifies an unseen review with 78 percent accuracy.

The RTS method has proven to be an entertaining example for teaching machine learning using Nave Bayes and Case Based Reasoning. The role of emotional classification is easy enough for students to grasp the difficulties, but complex enough for them to investigate the tradeoffs between different machine learning approaches. Within a medium-sized programming assignment, students can create a Nave Bayes classifier and learn the model's flaws firsthand by providing them with a training collection of movie and product reviews.

Expressing Emotion

Usually, programs involving speech and/or facial expressions/gestures are used to convey emotion in computer systems. Again, there is a plethora of work in this space, all of which will engage students in a classroom environment, such as systems that attempt to automate movements and expressions for an avatar (Breazeal, 1998; Breazeal, 2000), and those that improve emotional communication through computer generated speech (Breazeal, 1998; Breazeal, 2000). (Cahn, 1990). My work in the above serves as a good example of machines that convey emotion to introduce students to this idea. This work is part of the Buzz (Sood, 2007) digital theater installation, which has since gone online (www.buzz.com).

I wanted to give Buzz's digital actors the ability to express emotion through their computer-generated voices, so I put together a team of them. Text-to-speech engines are usually flat which emotionless, and would not make for an engaging performance. I decided to add a layer of emotional expression to an off-the-shelf text-to-speech engine (Sood, 2007). Cahn's work detailing the acoustic parameters of speech that shift with various emotional states influenced this sheet (Cahn 1990). A simple mood classifier solved the problem of when to convey emotion in voice (trained on a set of mood labeled blog posts from livejournal.com). The actual speech transformations were performed by an audio post-processing tool that changed the audio file of speech based on Cahn's proofs. The end result is a device that uses its voice to express emotion (consistent with the content of what it is saying).

3. EMBODIMENT

Finally, a system's embodiment allows for a more intimate interaction between the machine and the user. When a machine appears to be very human/animal in appearance, people often attribute other human features to it. This not only creates emotional bonds, but it also makes users more tolerant of the system's errors. Many online systems in e-commerce, tutoring, and training applications have recently begun to incorporate embodiment as a method of engaging/connecting with users.

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Although there are many examples of systems in this space, ranging from robotic seals to game-based avatars, I believe Kismet (Breazeal, 1998; Breazeal, 2000), a robot developed by MIT's humanoid robotics community, is the most convincing. Since Kismet is an embodied machine that senses, regulates, and communicates emotion in a social encounter with a person, it is a great example. Although this isn't the only device in this field, I believe it provides a convincing example of the state of the art in all areas of emotional intelligence.

4. WHY TEACH EMOTIONAL INTELLIGENCE?

Artificial Intelligence is a young and rapidly evolving field. Introductory Artificial Intelligence courses, in my view, must combine historical work with the current state of problems and approaches in the field of AI in order for students to obtain an education that will allow them to make future contributions in AI. Creating machines with emotional intelligence is becoming a popular topic in AI, and I believe that students will benefit from an introduction to this topic in an introductory AI course. Furthermore, the tasks involved in constructing emotionally intelligent machines are well-suited to AI techniques taught in introductory courses.

Building machines with emotional intelligence is a challenge that is fundamentally multidisciplinary, in addition to being an interesting subject. Many people believe that multidisciplinary work can appeal to a broader audience, attracting women and other underrepresented groups to computer science (Margolis, 2002). A perfect example of an application that illustrates "social significance" is the idea of emotion and machines with emotion.

Current artificial intelligence courses

In this article, I've compiled a list of tools and topics related to the evolving field of creating machines with emotional intelligence. Furthermore, I have explained why this topic is important and why it should be included in introductory AI courses, but I have yet to discuss how to integrate this topic into the context of existing artificial intelligence courses. I've experimented with two different ways of presenting this subject as a result of my experiences in two different courses.

The first approach entails looking into this subject towards the end of an introductory AI class. Russell and Norvig's text "Artificial Intelligence: A New Approach" (Russell, 1995) is commonly used in introductory courses. We teach Turing and Searle in response to the question "Can machines think?" The questions "Do machines feel?" and "Do machines perceive emotion?" are now being debated. These issues are equally critical in the field's philosophical foundations, and they can be expanded to address attempts to create machines with emotional intelligence.

The second approach, which I find more convincing, is to bring up emotional intelligence on the first day of class while "defining AI." I weave illustrations into the AI strategies I'm teaching during the semester. When teaching Machine Learning, for example, we talk about how to identify text's emotional content; when teaching speech generation, I show Janet Cahn's work on emotional speech and show These results were used in Kismet to create a more emotional voice (Cahn, 1990; Breazeal, 1998); while finishing up the chapters on agent-based jobs, they were used in Kismet to create a more emotional voice (Cahn, 1990; Breazeal, 1998), we discuss the embodiment of agents and the effects/reactions from users.

5. CONCLUSION

Within the field of artificial intelligence, the development of machines with emotional intelligence is a growing research area. To that end, I've compiled a list of research topics and sources. My experiences teaching this subject in artificial intelligence courses have been positive, and I've found it to be an interesting and relevant field of research.

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