CS 7637 – KBAI: Homework 3

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Question 1: Ants and Brains Analogy

Research and develop a model

For this question, the prompt asserts that there is an analogical relationship between ants and their organization within colonies and brain cells' organization in a brain. To illustrate this best, the following Figure 1 and Figure 2 show the relationship in components to the overall systems under being discussed. (Taschdjian 2018)

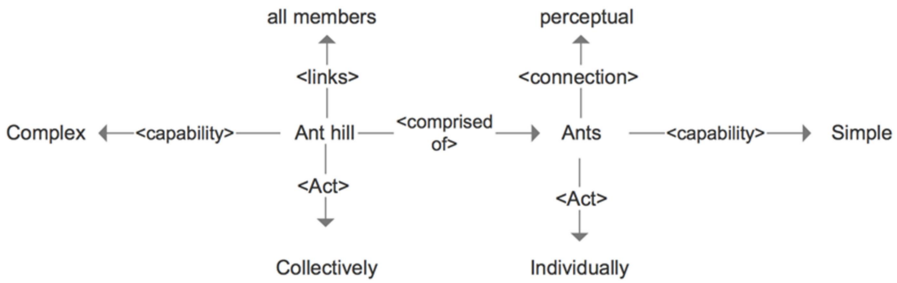

Figure 1: Ants and ant hills (Taschdjian 2018)

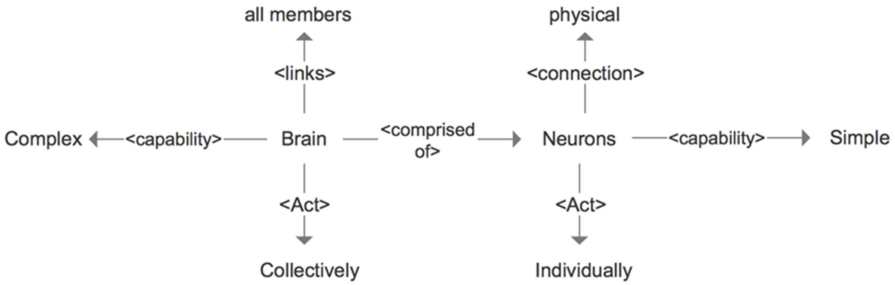

Figure 2: Neurons and Brains (Taschdjian 2018)

Contrast the two models

In contrasting the two models, the behavior of the collective seems very similar. An individual cell, same as a neuron, has basic primitive needs for self-

sufficiency such as food, or nutrients. Both have internal mechanics to process, store, and excrete energy sources. Both perform a function dictated by a society of organisms of same kind and interest. Neurons are relatively stationary, creating and destroying synapse connections to other neurons and transmitting electronic signals across defined pathways. Ants, however, are highly mobile, constantly seeking out food, shelter, or relative danger that may be posed to the ant hill. The ant performs a rudimentary sub-function of its society. (Holmes 2018) A neuron, on the other hand, is a neurotransmitter of the brain. A neuron has no investment in the functions of the brain overall, other than performing of its own functions. The self organization of the brain into the necessary compartments with the proper wiring and specialization necessary to enact such effects as consciousness, memory, or organ control and function is far beyond what an ant colony can achieve. The behavior of the colony is the only attribute that is reminiscent of what may thought of as a brain, since the decision making, rudimentary, cognition functions that are made in a colony exceeds those that can be done by an individual ant and thus show a form of collective cognition reminiscent of a brain. (Holmes 2018)

Assess Consciousness

As such, an anthill is neither alive, nor conscious. An ant hill is first and foremost a society, the members of which work together in specialized functions in order to provide for the continued survival and success of the colony. The neuron cells are also rudimentary agents which provide basic functions in the aid of a collection which then provides a higher function to an organism which is engaged in a society. As such, the brain cannot survive on its own, unlike an ant hill. Neither the neurons nor the brain have any intrinsic interest in the functions that a brain provides. It is the animal that contains the brain has the interest in using the brain as a tool whose functions are enabled by the brain cells. The tools that the brain in turn provides are those of consciousness, memory, control of peripherals, and perception of the senses, none of which are functions of the ant hill nor are necessitated by the society that makes up the ant hill.

Question 2:

Summary of 1st Paper

In a paper published in 2018 on AI, Ethics and Society Conference, "Regulating Artificial Intelligence: Proposal for a Global Solution", the authors Olivia J. Erdelyi and Judy Goldsmith make an extremely persuasive case for creating the rules, regulations, and an agency for AI oriented law and regulation. The authors propose a new international agency to overlook policy for developing AI methods, algorithms and agents. The agency would, of course, have to be internationally sanctioned in order to avoid fragmented approaches by domestic governments. The agency would comprise of expertise and interests of public, private and academic sectors. Most importantly, the distinction between soft and hard law is the driving factor behind determining the authority with which this agency would exist. More specifically, hard law is law that demands binding commitments has highly centralized administration and involves high sovereignty costs while incurring low long-term transaction costs. Soft law, on the other hand includes flexible cooperative agreements, low sovereignty costs, and minimal administrative functions. Beginning international AI development regulation with an agency deriving policies based on soft law and governing in guidelines, non-binding recommendations, and standards will allow to preemptively set up a pool of ethics for the future of AI. (Erdelyi 2018)

Assess Conclusions

Although the conclusions drawn by the authors are sound, the underlying reasons for creating such an agency seem overblown and overhyped. Killer AI and malicious intent is truly more a feature of the creators, not of the AI itself. AI is a tool, the use of which is implemented and developed by software engineers. If anything, what needs to be internationally created is a set of guidelines and policies for good software development and ethical engineering. Other professions and traditional engineering disciplines have had professional training and certifications for decades, yet software development has one of the lowest bars to entry. Especially with development of MOOC and other online platforms, anyone can begin developing AI agents at home. Maybe, instead of heavily regulating AI, the software engineering industry is the one that needs to be better established and regulated with ethics training and mentorship.

Brainstorm

For AI regulation, the ethical questions that must be addressed are the scope of AI regulation, the range of AI technologies that are to be regulated, and the clear definitions of what parts of AI development are regulated. However, pondering whether AI is responsible for its own actions or those who developed the technology is a more pressing question. Businesses, engineers, and consumers are all responsible for driving the demand for safe, consistent, and secure AI. If good engineering practices are used for such development, answering the big questions about AI's responsibility in it's own decisions become second-place.

Summary of 2nd Paper

In a paper published in 2018 on AI, Ethics and Society Conference, "The Dark Side of Ethical Robotics", the authors Dieter Vanderelst and Alan Winfield provide for a comprehensive test showing a case for why ethics implementation in robotics is necessary, and how it can be easily manipulated for malicious intent. The subtle, yet foundational assumption that the authors make is that if ethics can be implemented in robotic logic, then it must be implemented in order to make robots ethically conscious. The authors make the argument that background knowledge is the same for a robot that makes ethical decisions, regardless of who those decisions benefit. The only thing determining a course of action, for a robot, is simply one variable that either favors the outcome for the human positively, the outcome for the human negatively, or the outcome for the robot positively. Simply by modifying this one variable, the vast knowledge of the machine can be manipulated for either benevolent or mischievous purposes. The authors describe an experiment with two robots, one representing the machine and one representing a human. The human is directed by the machine to one of two outcomes. The machine is then programmed to favor human success, the machine's own success, or the human's failure. With this experiment, the authors demonstrate how simple it is to manipulate a single set of background knowledge for different ethical purposes. As the authors conclude, a possible solution is simply to exclude an "ethical layer" in the programming of robotics but admit that this may not be possible. (Vanderelst 2018)

Assess Conclusions

The authors make a valid conclusion toward the end of the paper. It is certainly valid to assume that ethical decisions can be manipulated, causing robotic agent to do harm. However, ethical decision making is certainly no different from other decision making processes for a robot. A properly secure system should not have issues in applying ethical logic to problem solving. The interpretation and action of the robot within the world is what must be controlled by humans more so than the implementation of ethical technology. In the pursuit of AI, ethical judgment cannot be a barrier to execution and should be implemented with all the necessary safety precautions required.

Brainstorm

The questions that must then be raised should ask how to fairly determine the right answer so it does not benefit any one group of people and how to protect the robotic logic against manipulation. What about the AI answers makes human agents trust the outcome? How can developers maximize trust within the system? These questions are the ones that should be raised. Similar to nuclear energy, which can be used for power cities or destroying them, AI may one day wield exceptional power. The questions to ask should be those that determine how we use AI, not how to block AIs development and stalwart its advancements.

Question 3:

Summary of 1st Paper and Major Contributions

In a paper published in 2018 on Neural Information Processing Systems Foundation, “Self Supervised Generation of Spatial Audio For 360 Video”, the authors Pedro Morgado, Nuno Vasconcelos, Timothy Langlois, and Oliver Wang present a novel methodology to train a learning system to transform mono audio with 360 video into spatial audio. The methodology used for the conversion of mono to spatial audio involved learning from spatial audio dataset obtained from YouTube video containing such audio. Two-dimensional Convolutional Neural Networks are applied in order to obtain high level features from the audio data and provide spatial location of the source. The dataset used by the authors was utilized in 75% for training and 25% for testing. In conclusion, the success rate of the methodology was 65% success with a user wearing in a Head Mounted

Display device versus 55% with a user viewing in an in-browser video. (Morgado 2018)

Weaknesses

It is interesting to note that the authors decided to use CNNs to train, evaluate, and conduct the translation from mono to spatial audio. CNNs are generally considered good tools for image and video processing and are used by the authors for the video processing. Utilizing the learning technique for audio spectrograph learning and processing initially seems inappropriate. It is possible that the researchers used the techniques already well paved in order to provide a working model but it I not evident whether the researchers attempted any other technique before settling on 2D-CNN for audio processing.

The possible weaknesses of the study are the datasets used to train the models and methods used to train and process audio data. The chosen datasets are limited and can be expanded beyond YouTube samples. Additionally, training of the model was produced by creating a mono audio source from the spatial source transformed to mono. The process for training could be improved.

Future Research

Furthermore, deeper research into other possible learning techniques should be further researched. The success rate is not impressive and only barely passes above simple chance guessing. In order to be successful, other models of learning may require research, especial ones that are more refined for audio processing than 2D-CNNs.

Summary of 2nd Paper and Major Contributions

In a paper published in 2018 on Intelligent user Interface Conference, “FocusMusicRecommender: A System for Recommending Music to Listen to While Working”, the authors Hiromu Yakura, Tomoyasu Nakano, and Masataka Goto present a novel music player which analyses and selects music centered on providing increasing concentration for the listeners. The key differentiator for this music service is that the music should not be distracting or impeding a listener’s concentration on other work. More specifically, music that is “very liked” or “very disliked” by the listener is usually distracting, and thus this music service

focuses on selecting music that is “neither liked nor disliked”. By using predictive algorithms and feedback from a user’s concentration on a work task, the music service successfully selects audio tracks that do not distract the listener, but enable him. In order to limit the interruption of the service to its users, a feedback button is implemented so the user can either “continue listening” or “skip” a particular track manually. Additionally, the user’s use of the keyboard, mouse, and web browsing is used in order to properly queue the next song to follow in order to maintain concentration levels or increase them if concentration is currently low. In a user experiment on 8 subjects, the accuracy of concentration prediction was 70% and the users felt that the music selected by the software did not break their concentration. As intended, the users neither “very liked” nor “very disliked” the music automatically selected to be played for them. The music selected by the authors was gathered from VOCALOID tagged music which were useful for their experiment due to their accurate, user-corrected chorus chorus sections available via Songle Widget application. Additionally, the tasks performed by the users included essay writing and programming on a personal computer while wearing headphones and having the keyboard, mouse and web browsing monitored by the authors. (Yakura 2018)

Weaknesses

The weaknesses of the study include a very small user sample count, small range of music played and a small amount of tasks performed by the subjects under test. Although the feedback from the subjects proved to validate the authors theory, a larger sample size should be considered to draw concrete conclusions. Additionally, different tasks require different concentration levels (i.e. assembly line versus programming) and thus require different music to be played for proper concentration. In limiting the amount of variables, the authors demonstrated a proof of concept, but fell short of providing a novel technological breakthrough.

Future Research

The next steps for this research should focus on the shortcomings described. A larger pool of music, a larger set of subjects and subject matter for work environments all have to be considered as variables for research. Considering work environments such as assembly lines or reading would also require a change in asserting user concentration levels. As such, the methodology to determine

concentration would also have to be considered for future work. By narrowing down all these factors, the authors attempt to demonstrate a one-size-fits-all solution. In order to truly assert such a claim, a much farther reaching pol of variables must be considered and possible novel testing and monitoring techniques developed.

Question 4:

Lecture Question

Create a Script for how one would go about creating a software application. Determine if different scripts are required for Agile methodology versus waterfall methodology. Include a diagram of frames and different tracks if needed.

Ethics Question

Research the differing opinions on how AI wil impact labour and the workforce I the future. Cite at least one article describing how AI will cripple and eliminate entire industries as well as at least one article describing how AI will replace some jobs but will either have no overall impact or actually help grow the labor work force of humanity.

Random Question

Explore the possibility of higher order Raven's Progressive Matrices problems. Imagine an RPM of 4x4 or 5x5 images or alternatively, a multi-dimensional RPM matrix such as 2x2x2 cube or 3x3x3 cube. Discuss whether high order matrices would help an AI algorithm determine the correct answer faster or complicate the AI to unmanageable time allocation needed to solve the problem. Pick one alternative matrix model and include an image of it in the report together with the possible answer keys. In short summary, describe how you would go about tackling the challenge of solving the RPM and more specifically, what new methods you may have to employ, or whether the methods from the original 2x2 or 3x3 problems would be sufficient.

New Project Track

Inspired by AlphaGo, a possible new track for KBAI could be to create a student designed version of a rules-following AI agent to conquer a game, this project

would be called AlphaPlay. The agent would have to be taught certain rules and goals of a game (as background knowledge) and spend some cycles training itself. For each project, the student would be presented with a representation of the game board snapshot in the middle of a game. The AI agent would then have to determine what would be the best next step to take in order to find the shortest path to victory. For example, in project 1, the rules can be those of checkers. The AI would be presented with an image of middle-of-game snapshot and asked which move would produce a winning result. The AI would then have to analyse and determine the maximum amount of checkers it can capture with one move. In project 2, the AI could be presented with a middle-of-game snapshot of chess with a "check" state. And the AI would have to determine the best course of action in order to guarantee a "check-mate". In project 3, the AI source code would be uploaded to a server and used to play against a TA created AI. In the 3rd scenario, the AIs will face off in a chess match with the TA-AI providing chess snapshots of valid moves to the student-AI and calculate if the student AI can win, how many moves it would take to win, and whether the moves are optimal. The problems can be short with 3 valid moves needed to win or less.

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