Real-World AI Solution

MyBuddy

At a time in the world when content is immediately manifestable at any given moment, a lot of us can find ourselves struggling to get motivated and stay on track to reach our goals and live the life we really want to. In another paper, I previously introduced my concept for *MyBuddy* – your new favorite AI assistant and friend! *MyBuddy* utilizes the power of large language models (LLMs) and deep learning (and a soft, cuddly exterior) to learn about the things you love to help you stay on track and stay motivated! *MyBuddy* works by implementing what Goel and Davies (2019) consider to be the three major branches of artificial intelligence (AI): machine learning (ML), cognitive computing ("cognitive systems"), and robotics, at least according to Goel & Davies (2019). Initial training and updates will involve a combination of modern ML techniques and custom algorithms. *MyBuddy* requires speech-recognition, computer vision, the ability to hear in 3D space (dual microphones), the ability to speak (speakers), as well as integrated sensors for "feeling" and seeing the "invisible" environment. The product will need a local embedded system with an AI CPU and GPU and other typical system components. Wi-Fi (or USB-C) will be included to download updates, utilize high-performance cloud computing, and access secure database servers. SHA (secure hash algorithm) and salt will be applied to passwords, and AES encryption will be applied to all data in transit and at rest. Bluetooth will be included to allow users to configure *MyBuddy* from the "*MyBuddy*" app (available on Android, iOS, MacOS, and Windows). Dual rechargeable lithium-ion batteries will be included with USB-C fast-charge compatibility. Ethical concerns include privacy and data transparency concerns, as well as ensuring *MyBuddy* acts in accordance with a code of conduct.

Updated Changes

My original ML pipeline only included a few (general) ML techniques, such as supervised and unsupervised learning. After further research during this course, I now would suggest implementing a combination of the following techniques:

- **reinforcement learning** (**RL**): *MyBuddy* agent will seek to maximum the (discounted) cumulative reward over time (like dopamine-driven biological brains)
- **supervised learning**: explicit instruction using language-driven generality from developers and prototype testers
- **unsupervised learning**: allows agents to find patterns from the environment (state, action, and reward) without explicit instruction, leading to high variance and generalization, which is desirable for an agent that needs to be able to "understand" and communicate with the user
- **deep learning** (**DL**): complex patterns and high-dimensional sensory data require multiple layers of densely connected artificial neurons and their parameters (weights) that are used as adjustable coefficients used to minimize the loss function
- **recurrent neural network** (**RNN**): uses internal memory to handle sequential data (time series) to maintain context and connections across the input sequence
- **natural language processing**: necessary for a language-driven agent
- **convolutional neural networks**: used with pooling (compression) and optimized for image recognition and spatial hierarchy of image observation inputs
- **transfer learning**: allows the agents to transfer knowledge from one domain (environment) to another, enhancing learning efficiency and adaptability (generalization)
- **episodic learning**: allows agents to compare episodic memory of the most similar past environments to find the highest cumulative value action
    - EXAMPLE: **state**: "near-by sad user" → **high reward**: "hugging the user"

- **meta-learning** ("learning to learn"): one (slow) algorithm creates another (fast) algorithm by slowly adjusting its parameter weights, leading to a new RL algorithm that learns quicker via strong inductive bias from past experiences
- **gradient descent (GD)**: optimization algorithm used to minimize a function (find the local minima) that can improve performance by gradually shaping the state representations (embeddings) by adjusting the parameters (weights)
    - **gradient**: vector that points in the direction of the steepest increase of the function
    - **parameters**: adjusted in the opposite direction of the gradient to reduce the loss (step size taken in this direction is controlled by the learning rate hyperparameter)

Addressing Ethical Concerns

The use of any data obtained via *MyBuddy* will be disclosed to the user, in a transparent and timely manner. Best practices in software security and ethics will be implemented, following industry standard guidelines, including those set forth by the following entities:

- IEEE (Institute of Electrical and Electronics Engineers)
- ISO (International Organization for Standardization)
- W3C (World Wide Web Consortium)
- ANSI (American National Standards Institute)
- NIST (National Institute of Standards and Technology)
- ACM Code of Ethics and Professional Conduct
- Markkula Center for Applied Ethics

A code of conduct will also be implemented as well. Following industry-standard best practices for user privacy and security can help protect the user's privacy and personal information, as well as the developer's reputation!

References:

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Goel, Ashok & Davies, Jim. (2019). *Cambridge Handbook of Intelligence: Artificial Intelligence*. Cambridge University. https://www-cambridge-org.ezproxy.snhu.edu/core/books/cambridge-handbook-of-intelligence/artificial-intelligence/B994B0D29512087BF53979CA9EABC9AB.

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