DinoAI - An interactive self-playing retro game/ display for exploring Machine Learning concepts

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Abstract

In this work we put forward DinoAI, an AI-based display and dynamic learning environment that demonstrates to the public how AI/ML works under the surface and creates an engaging retro-looking self-playable game. DinoAI works in multiple layers: as a display that stimulates public interest in AI, as a communicator of basic knowledge of key AI concepts, and as an interactive hands-on learning environment for participants.
DinoAI is available at: https://dinos-ai.netlify.app/

Artificial Intelligence (AI) and Machine Learning (ML) have exploded in recent years, revolutionizing every field, from medicine [9] and art [5, 8], to security [12, 10] and air quality [11, 1]. This trend shows no signs of slowing down, with advancements coming from both new algorithms and the analysis of ever-growing datasets [17]. Our everyday lives are now packed with AI features like facial recognition, voice assistants, and navigation, however most people lack a basic understanding of how AI operates, despite interacting with it daily. This widespread use highlights the need for simple, accessible and easily explainable ways to diffuse AI/ML education to the public, especially youngsters, preparing for the future of human-machine collaboration.

Our effort puts forward DinoAI[1], the *first AI-based self-playable educational game/display* that demonstrates the process of training and utilizing Neural Networks (NN) and genetic algorithms with simple concepts and easy to follow visuals. In particular, our proposal takes inspiration from Google's Dino game [18], but with an important twist: our dinosaurs are self-playing [3, 4, 6]. While the original game requires human control, our version allows you to witness the dinosaurs' actions driven by an artificial NN, while at the same time being able to witness the changes in the NN itself. This allows us to

[1] Available at: https://dinos-ai.netlify.app

showcase the power of ML by visualizing the underlying NN architecture and its learning progress in real-time in a simple, yet intuitive manner.

To train this network, we used the NEAT algorithm [13], which mimics the principles of natural selection to guide its evolution; each generation has a number of dinosaurs with randomly generated NNs at first. When a generation comes to an end, a new generation will take its place, and some dinos from the previous generation will have a better NN setup, based on the achieved score. Better score/fitness means more "children" in evolutionary terms, where every child will either surpass or fail its parent. Eventually, this process will lead into an upward trend in the *score vs generation* graph, eventually reaching the "perfect" dino creation/mutation. This means that there cannot be any better changes to the weights of the NN and our goal is reached: the game will be able to play itself forever without losing or getting tired.

Beyond entertainment, DinoAI works in *multiple layers*: it acts (i) as a *display* in the spirit of [7] that stimulates public interest in AI, (ii) as a *showcase of evolutionary programming* focusing on communicating basic knowledge and understanding of key AI/ML concepts (e.g., training time, randomness, generation size, feature and model selection) to students and public in the spirit of [2], and (iii) as an *interactive hands-on learning environment* (as in [16, 15]) that lets users experiment with various ML concepts and their effects. DinoAI allows users to dynamically adjust not only basic ML parameters such as generation size, reproduction algorithm, punishing behavior (e.g., useless jumps), affecting input (e.g., blinding the dinos), but also the very architecture of the NN (e.g., modifying the number of hidden nodes), thus fostering a deeper understanding of how these constructs operate. Other features of the interactive environment include the ability to save/load the DNA of your favorite dino, to play against the AI, to start/pause the game and to show/hide various on-screen elements.

Moving beyond traditional research which often focuses on whether humans control games or games manipulate humans [14], DinoAI proposes a novel approach that transcends the traditional player-versus-game paradigm and instead focuses on the learning process within the AI/ML context. Rather than emphasizing human interaction with games, it aims to demonstrate to the public how AI/ML works under the surface. To do so, it utilizes an engaging retro-looking display with an ever-changing neural network that inspires user's (self-)reflection on evolution, both in the physical and the digital world.

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