Optimizing Heuristic Search Algorithms using Neural Networks

OUARDI Amine

ENSET Mohammedia – Hassan II University, Casablanca, Morocco

Abstract:

At the opposite side of the uninformed search algorithms, performing a systematic search, heuristic search algorithms are based on multiple rules leading it to estimate, in a predictive way, the minimal cost of the path from the current state to the goal.

In this sense, A* algorithm is an example of heuristics-based algorithms that can guarantee to find a least-cost path to a goal state if this algorithm is using an "admissible heuristic". A heuristic is said to be "admissible" if it never overestimates the real path cost from the current state to the goal. Furthermore, if the condition $h(x) \leq d(x, y) + h(y)$ is satisfied by the heuristic h (d denotes that edge length), for every edge (x,y), then h is called consistent. And with consistent heuristics, finding an optimal path without processing any node more than once is guaranteed.

The main idea consists on developing a Neural Network that can optimize those heuristics to further refine the A* algorithm results. Towards achieving that goal we must find the best synaptic coefficients, for that reason, a learning phase will be needed during which the network parameters are adjusted until the best admissible and consistent heuristic is obtained, dominating any other heuristic (h1 dominates h2 if for every node n (state), $h1(n) > h2(n)$).

During this learning phase, and as inputs, the neural network will have some representative examples in the form of pairs of several problems and heuristics ({P1,h1};{P2,h2}...{Pn,hn}), to finally be able to calculate the best heuristic regardless of the inputs.

Biography:

OUARDI Amine, 27 years old, head of Architecture perimeter, ELIS project, Capgemini; Artificial Intelligence PhD student at ENSET Mohammedia, working on optimizing heuristics search algorithms using Neural Networks. Had a Master's degree in Imaging and Business Intelligence, with a graduation project on the Internet Of Things, including QR codes and NFC technology. Got a fundamental licence degree in Mathematics and Computer Science, with a final project related to Genetic Algorithms: studying optimal solutions for the Travelling Salesman Problem.

Publication of speakers:

1. Amine OUARDI, Relative landscape maturity in the South Rifian Ridges (NW Morocco): Inferences from DEM-based surface indices analysis, Applied Computing and Geosciences, Volume 6, June 2020, 100027

2. Amine OUARDI, Active tectonics in the Moulay Idriss Massif (South Rifian Ridges, NW Morocco): New insights from geomorphic indices and drainage pattern analysis, Journal of African Earth Sciences, Volume 167, July 2020, 103833

3. Amine OUARDI, Synthesis and characterization of arginine-doped polyaniline/walnut shell hybrid composite with superior clean-up ability for chromium (VI) from aqueous media: Equilibrium, reusability and process optimization, Journal of Molecular Liquids, Volume 316, 10 October 2020, 113832

4. Amine OUARDI, Relationship between vertebral fracture prevalence and abdominal aortic calcification in women with rheumatoid arthritis, Bone, Available online 18 August 2020, 115599, In Press, Journal Pre-proof

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