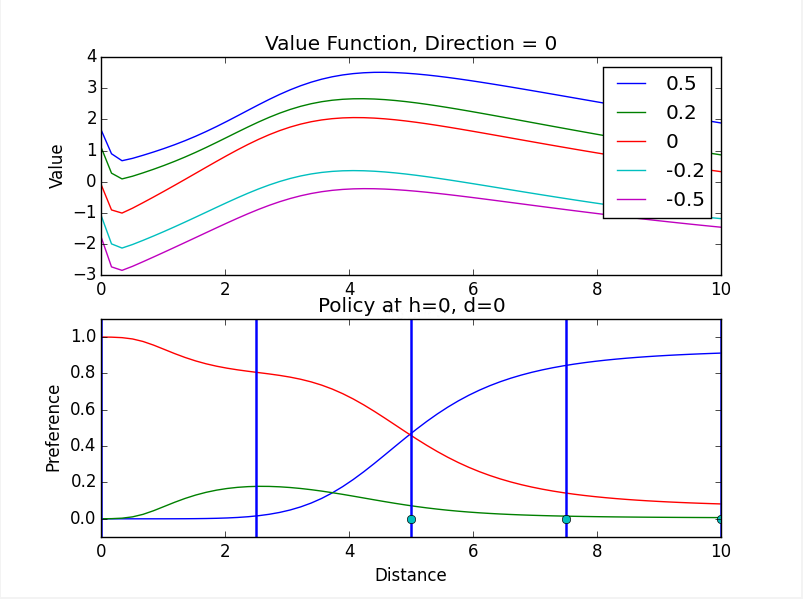
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Under the centroid method, the UAV circles the estimated thermal center at a fixed radius. One improvement on this method is to develop strategies for extracting energy from the thermal that are more flexible. We investigated three approaches to achieve this with machine learning: tabled-based Q learning, neural fitted Q learning, and dynamic programming with neural interpolation. Tabled-based Q learning discretizes the state space, and develops estimates for the value of performing each possible action in each discretized chunk using Q learning. We used this method successfully in a highly idealized setting, but we had some difficulty in using it to scale it up. Future work could include focusing on variable chunking size, allowing for better scaling. Neural-fitted Q learning also uses Q learning, but stores value estimates using a neural network. We had only limited success with this method, and future work would focus on incorporating new information into a neural network without losing the old information stored. Dynamic programming with neural interpolation is a model based method, using a model of the system to carry out dynamic programming. To allow for a continuously varying policy, the value estimates and policy estimates are both stored in neural networks.

RESULTS:

We had the most success using dynamic programming with neural interpolation. A plausible and flexible policy was developed that adjusts to thermal position and shape. State variables used were: position from center of thermal, height of UAV, and direction of UAV. Current work is focused on testing the algorithms developed in the more sophisticated ccrcsim simulator.