Comparison of K-Nearest-Neighbor and Neural Networks for Human Detection with Thermal Imaging

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The purpose of this project is to compare a K-Nearest-Neighbor (KNN) algorithm with an Artificial-Neural-Network (ANN) in terms of their accuracy when detecting humans by use of thermal imaging. A small autonomous rover controlled by a Jetson Nano was built to evaluate the capabilities of the developed algorithms to locate humans in a simulated natural disaster scenario. The thermal imaging portion of the robot consists of an MLX90640 sensor and a Teensy 4.0. The Teensy controls and monitors the thermal imaging sensor, converts the data to a single string, and sends the data to the Jetson Nano. The Jetson Nano then reformats the string appropriately for input to the KNN and ANN algorithms. The algorithms report if there is a human somewhere in front of the robot. The robot also had a video camera that is used to detect edges/obstacles for the robot to avoid. An algorithm was developed that obtains a burst of frames from the video camera, and for each frame takes a Canny mask, finds the Hough lines, and appends them to a blank frame. The algorithm then combines the short lines from the blank frame into long lines to identify obstacles. Testing the algorithms with model data shows that the KNN is better than the ANN by only a slim margin. However, when using a live thermal camera reading it can be seen that the KNN is significantly more consistent than the ANN, which often detected a human when there were no humans.

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