Image Data Collection Rig for Training AI in Orientation and Distance Detection

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Many current AI models focus on object detection and avoidance. In order to collect objects rather than avoid objects, the distance and orientation of the object are crucial. This project focuses on automating a currently complex human oriented process by developing a data collection robot and data processing code. The objects considered in this project are oak leaves assumed to be lying flat on the ground surface. As the ground distance increases, the tilt angle relative to the elevated camera changes. The track in the rig is considered to be oriented along the camera's view direction. The robot moves along the track to the associated slope distance. The robot can then spin a swiveling table that holds an object to any desired pan angle. In this way, the robot can produce a range of precisely measured angles and distances while the camera captures images. Through the use of Jupyter Notebook, OpenCV, and PyTorch, the collected data is prepared and used to train and test a Deep Neural Network (DNN) to predict distance and orientation. The rig was tested and successfully produced over 25,000 labeled images that were used to train a model. The DNN trained for 60 hours and calculated the orientation of an untrained leaf with an average error of -12 degrees and the distance with an average error 0.07 meters. This approach has application to a broad range of object orientation training tasks in machine learning.

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