Can Machines Learn to Design Better than Humans?

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While Machine Learning has made great strides in predictions, less research has been done on the application of AI to the engineering design. The purpose of this research was to test machine learning algorithms against expert human designers to see how they would perform. The question investigated was to test how well machine learning algorithms could perform in the design of complex power trains of racing drones, specifically the selection of brushless motor and propeller combinations to optimize particular design objectives. Racing drones were chosen because of the high stakes of the competition and the high complexity of the engineering problem. Detailed characteristics and performance data were collected for 16 brushless motors and 18 propellers in more than 112 tests of motor - propeller combinations. From the performance data, three variables were extracted: i) maximum thrust, ii) efficiency, and iii) dynamic punch. The training data was used to train three different machine learning algorithms: Neural Network, Local Weighted Regression, and Boosted Decision Trees. A testing data set of seven motors and eight propellers was presented to the algorithms to select the best performance combinations. The same choices were presented to eight recognized experts in the field, and their performance was compared against the machine learning algorithms. Despite some good performances by humans, the AI algorithms beat the best humans in two of the three contests. The machine learning algorithms were particularly impressive in finding the optimal powertrain design to optimize punch - arguably the most important dimension in drone racing.

Awards Won:

Third Award of $1,000