



**CALIFORNIA STATE SCIENCE FAIR  
2017 PROJECT SUMMARY**

<b>Name(s)</b> Austin A. Patel	<b>Project Number</b> <b>S1520</b>
<b>Project Title</b> <b>Neural Networks for Handwritten Letter Recognition</b>	
<b>Abstract</b> <b>Objectives/Goals</b> Teaching a computer to learn to classify handwritten letters requires a complex computing model capable of learning the structure of letters rather than simply following a set of explicitly coded parameters. This challenge requires a machine learning algorithm, such as a neural network that simulates the human brain, to learn over time from training data. The goal was to create a neural network and test various learning algorithms to see which was best for predicting handwritten letters. <b>Methods/Materials</b> Materials: Computer with Java programming language installed. A Java program was written from scratch including a user interface for drawing letters, a neural network and three learning algorithms. Fourteen participants drew a total of 3,640 letters used for training and testing. The letters were used to train a neural network and were later classified by the program. Different learning algorithms were used to classify the letters and their performance was analyzed. <b>Results</b> By initially training with a genetic then a backpropagation algorithm, the accuracy of predictions reached 80.12%. Most of the algorithms ended up with similar overall accuracies, except for the genetic algorithm which peaked in performance and then got worse. Using multiple algorithms in conjunction resulted in better performance. <b>Conclusions/Discussion</b> The results support the idea that algorithms that do not rely on training data are better at predicting letters that do not necessarily align to a specific shape. As detailed in the discussion section, the most significant findings from this experiment were the specific use cases for each algorithm and why each algorithm performs and produces the output it does.	
<b>Summary Statement</b> I programmed a neural network and its learning algorithms that I used to classify what letters people drew.	
<b>Help Received</b> None, I programmed everything and executed the project myself.	