



CALIFORNIA STATE SCIENCE FAIR  
2016 PROJECT SUMMARY

<b>Name(s)</b> Daniel Bolya; Dylan McLeod	<b>Project Number</b>  36642
<b>Project Title</b> Using Artificial Intelligence Systems for Autonomous Visual Comprehension and Handwriting Generation	
<b>Abstract</b> <b>Objectives/Goals</b> Our object is to see if multiple neural networks can be used in a pipeline to parse various types of offline math problems and generate a handwritten answer as well as a human would (with at least 95% accuracy). Note: offline here means as an array of pixels, while online means as a collection of points and strokes. <b>Methods/Materials</b> Laptop and C++ compiler suite along with libraries for image processing and neural networks. We also used a lot of different openly published training data sets. The pipeline process an image of a worksheet taken from a webcam in a series of five steps: division, identification, parsing, solving, and finally writing the answer. <b>Results</b> We found the accuracy of our pipeline to be difficult to measure, as even though all the components are above 90% accurate on tests sets, the actual input of the pipeline is a real-world image which can vary greatly in quality, readability, and style. Thus, further testing is required to analyze its specific accuracy. <b>Conclusions/Discussion</b> While the scope and breadth of our pipeline does not greatly improve on previous equation recognizers#especially online ones#our applications are not deeply rooted in equation parsing, and thus many of the same concepts can be used to solve other difficult tasks such as grading simple free-response tests.	
<b>Summary Statement</b> We showed that a pipeline of image processing and neural networks is a good way to solve handwritten math problems.	
<b>Help Received</b> None. We designed, implemented, and constructed this project ourselves.	