Project ID: 611
Junior Division
Computer Science and Systems Software

Rishabh Bhatia
The Rhoades School
Gr. 6

Efficacy of Machine Learning Algorithms in Detecting Misinformation

AWARDS:

> ***Armed Forces Communications Electronics Association (AFCEA) Junior Division Winner***
> ***Office of Naval Research - Junior Division Winner***

Unfortunately the use of social media and the internet has led to widespread misinformation. I wondered if it were possible to detect whether a message on the internet was "fake news". I found several different Machine Learning algorithms to analyze articles. My project attempted to discover which algorithm was most dependable in identifying misinformation. I hypothesized the Machine Learning algorithms would be successful in identifying misinformation, but some algorithms would be more reliable than others.

The datasets for training and testing involved 21,533 inputs. I used half of the inputs to train the algorithms and the other half for testing. I trained and tested 8 algorithms and repeated the experiment in three trials. Python code was used to evaluate the Machine Learning algorithms and multiple Python libraries with pre-coded algorithms were accessed. I wrote the code to train each with data and tested for accuracy. Kaggle was used as the Python editor. I added a function to allow me to input news and test.

Decision Tree, Gradient Boosting, SVM, and Logistic Regression were all very reliable in detecting fake news with accuracies ranging from 99.33% to 99.68% In this experiment KMeans, KNN, Naive Bayes, were unreliable with mean accuracies of only 48.30% to 58.04% correct. Random Forest had an accuracy of 76.21%.

AI appeared faster and more accurate than a potential human expert fact checker. Based on my experiments, not all of the algorithms are reliable, and it's important to know which ones are more accurate.

Project ID: 612
Junior Division
Computer Science and Systems Software

Samira Harbin
Chula Vista Middle School
Gr. 8

Is AI Art Consistent?

The purpose of this experiment was to find out if Ai generated is consistent. The experimental question was, "Is Ai Art consistent?" The hypothesis was how if the Ai generator gets the exact same input when generated multiple then the image will be consistent because all the Ai needs to accomplish is to follow the input which would be exactly the same. To conduct this experiment the Ai generator should have a simplistic input which would be generated 11 times. After this all of the 11 generated images would be printed. The first generated image would be getting overplayed by the other 10 generated images. Lastly record the data by counting each and every difference in each paper getting overlapped with the first generated paper. The results of the experiment showed that Ai art is indeed consistent. The hypothesis was supported because all of the counted differences were consistent and the average was under 5 which would mean it would be consistent.

Project ID: 613
Junior Division
Computer Science and Systems Software

Junyoung Huh
La Jolla Country Day School
Gr. 7

Determining Water Consumption Based On AI

The purpose of this project was to use AI to find out which condition, weather or physical, is most accurate and consistent for causing change in water consumption. The main objective of this was to see if there is a way to output predictions and forecasts of how much water would be drunk in a certain time period.

This project started with data on an individual's water consumption and physical activity, which was downloaded as CSV files into a Pytorch AI in Spyder. Every time the code was run, the AI would produce slightly differing predictions of water consumption in the form of line graphs. The traditional method based on numpy and mathematical calculations that would form a correlation matrix was also used in this project, which was more accurate for analyzing historical data, but was impossible to use for predictions with an undefined amount of variables.

The results showed that temperature was the most important and consistent cause in change of water consumption. However, in the prediction graphs of nearly every variable, there were occasionally errors and gaps in the graphs due to a small lack of consistently collected data. This suggests that if more data had been collected, it would have been much more clear in graphs and in the correlations on which condition is the most accurate and consistent variable for causing changes in the water consumption of an individual.

Project ID: 614
Junior Division
Computer Science and Systems Software

Mikhael Kamshad
San Diego Hebrew Day School
Gr. 8

Object Classification Headset for Assisting the Blind

AWARDS:
The RED Award
Broadcom "Coding with Commitment" Award
Lemelson Early Inventor Winner
CSEF Qualified
Thermo Fisher Scientific Junior Innovators Challenge Nominee

The goal of this project was to create a device that could guide visually impaired people both in the street and in the grocery store. The final model was a Raspberry Pi 4 and battery pack mounted onto a 3D printed headset, along with a pushbutton for properly shutting down the device connected by Bluetooth to a set of open-ear bone conduction earbuds. The device used a Tensorflow lite image classification script that was modified to run headless, verbally output the results, and shut down the device when the pushbutton was pressed.

The device was tested on its accuracy in detecting various street and grocery store objects. During testing, the device struggled with some objects while easily detecting others. It scored impressively high on bananas and lemons, at 59% and 51% average certainty, respectively, but struggled with apples (12% average certainty) and didn't detect avocados or stop signs at all. It also scored decently high on street signs, at 47% average certainty, and okay on the rest of the street objects. With a little bit of improvement, this device will provide a safe way for visually impaired people to go out and grocery shop.

Project ID: 615
Junior Division
Computer Science and Systems Software

Sophia Zhou
La Jolla Country Day School
Gr. 8

Password Cracking

AWARDS:

Office of Naval Research - Junior Division Winner

The purpose of this study was to find out what password is the strongest against attacks. Everyday, there are 5.3 million users on the internet (Shewale, 2023), and all of these people have the same chance of getting hacked. The goal of this study was to find the best password possible for everyday use that is hard for a brute force attack program to guess. In the project, there were three different programs; one that guessed numerical passwords randomly, one that guessed them randomly, one that guessed them numerically, and another that could brute force passwords. The numerical passwords were tested with six digit passwords. The other passwords were of various difficulties, ranging from three character passwords all the way to 11 character passwords. For the procedure, there were different programs, and to test the password, it was entered and the computer made guesses until it was the right match. The results showed that a password with one character took 37 tries to guess. A password with three characters ("sun") took 259,183 tries to guess. A password with four letters ("pass") took 21,695,135 tries to guess. A password with seven letters ("8sHag2&") took 5,727,817,042,720 tries to guess. The results showed that passwords which were more complex (assuming complex means longer) are stronger than passwords that are shorter because the program used in this study guessed passwords randomly. If additional testing was done, maybe shorter passwords with more symbols and numbers could be proven to be strong as well.

Project ID: 616
Junior Division
Computer Science and Systems Software

Ahmad Zubaidi
Bright Horizon Academy
Gr. 8

VR: A Solution to Dementia

AWARDS:

BD "Advancing the World of Health" - Junior Division 2nd Place
Armed Forces Communications Electronics Association (AFCEA) Junior Division Winner
CSEF Qualified

This project addresses the limitations of current dementia treatments by exploring Virtual Reality (VR) as a memory improvement tool. With many pharmaceutical treatments lacking reliability and causing long-term side effects, the project focuses on creating non-pharmaceutical treatment, a VR game that mirrors a user's living space to provide a stimulating memory challenge. Utilizing Unity software and an Oculus Quest 2 headset, users navigate a virtual environment resembling their own, completing tasks like identifying items, and returning items to their correct places. Successful completion is rewarded with a celebration screen and points, aiming to motivate daily practice and potentially enhance quality of life (QoL). The development process involved connecting the Oculus Quest 2 headset to the Unity space, opening a 3D URP template, adding grabbable items with physics properties, and designing a living room environment. Testing confirmed the game's positive impact minimum side effects, but further enhancements are planned for realism and compatibility with dementia patients' conditions. Future steps include using an augmented reality environment to minimize disorientation of patients. This will require a more advanced headset similar to the Apple Pro Vision, and the Oculus Pro. I would also be seeking IRB approval to test the program on real patients, with the goal of validating its effectiveness as a memory enhancement tool. This platform has the potential to be used as a communication tool with advanced dementia patients through possibly eye recognition movement and AI based analysis.

Project ID: 617

Junior Division

Computer Science and Systems Software

Samarth Vaka

Oak Valley Middle School

Gr. 8

Avni Chavan

Oak Valley Middle School

Gr. 8

Weather Prediction

AWARDS:

Armed Forces Communications Electronics Association (AFCEA) Junior Division Winner

The primary goal of this project is to try and enhance the accuracy of weather prediction by leveraging the available machine learning models.

It is hypothesized that a combination of advanced machine learning models like Random Forest, K-Neighbors Neighbors, SVM and human analysis, could revolutionize weather forecasting by improving the accuracy in weather prediction. Further, with advanced techniques like GridSearchCV, for optimizing hyperparameters in machine learning models, far more accurate results can be achieved.

Procedure: The procedure involved analyzing past weather data for Seattle, incorporating data features like temperature, wind speed, and precipitation. We prepared the data for analysis by running it through multiple pre-processing algorithms like removing null values and removing outliers. All of these steps helped in getting the best out of the models we used. We then ran the data through a list of models and compared them for efficiency and accuracy. By using GridSearchCV, we were able to show improved accuracy.

Results: The results highlighted that we could improve the accuracy in weather prediction from the best machine learning model KNN Classifier by another 6%, and from the SVM classifier by almost 60%.

Conclusion: We concluded that by optimizing the hyperparameters of a machine learning model, we can improve the accuracy in weather forecasting. There is room to further investigate other models and achieve much better results in the field of weather prediction.