Research Experiences for Teachers and Young Scholars in Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST)

Augmenting Images Through Brightness, Contrast, and Position Control to Train a Convolutional Neural Network

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Abstract

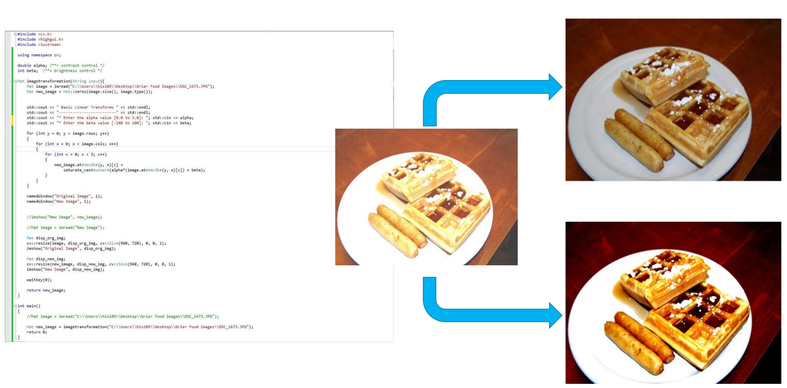
During this project, a convolutional neural network (CNN) was trained to identify different classes of breakfast food. This research is unique because image augmentation was employed to increase training data.

Purpose

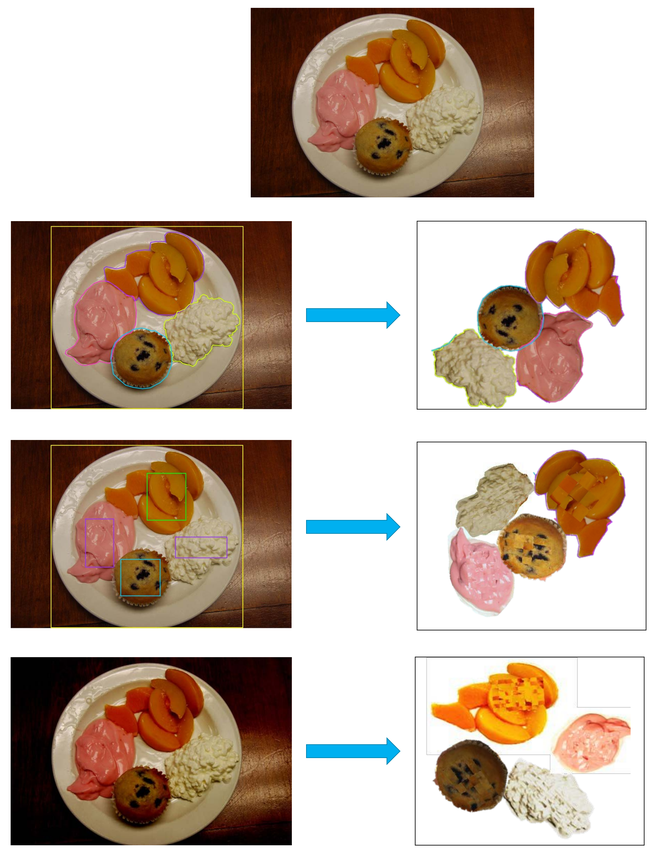
This project is funded through NSF by the ASSIST grant, a program working to develop a small wearable device that will detect biological and environmental factors. The motivation for this visual recognition project is to identify different foods through a camera and report back information including nutrition facts, possible allergens, and a brief description. This would link to an app containing a list of personal food intake and make suggestions (ex: two more servings of fruit today). Research in this area will help people to live a healthy and balanced lifestyle based on their own bodies.

Coding

The coding to transform the initial data was done in C# on Visual. My code extracted foods from the images and randomly changed their contrast and brightness to create new data. Programming allowed this research to be unique because instead of searching for more data, we generated it. Because of the nature of a neural network, the more images used to train, the better our accuracy could be.

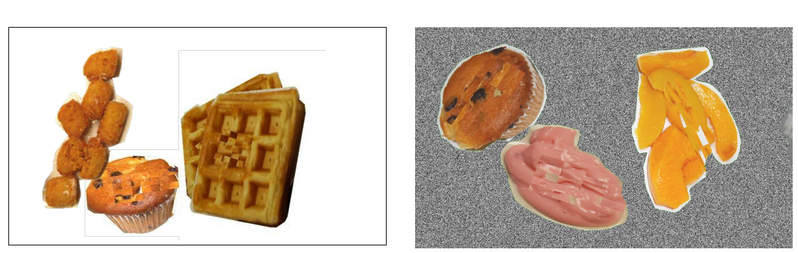


Methodology: Creating the Images



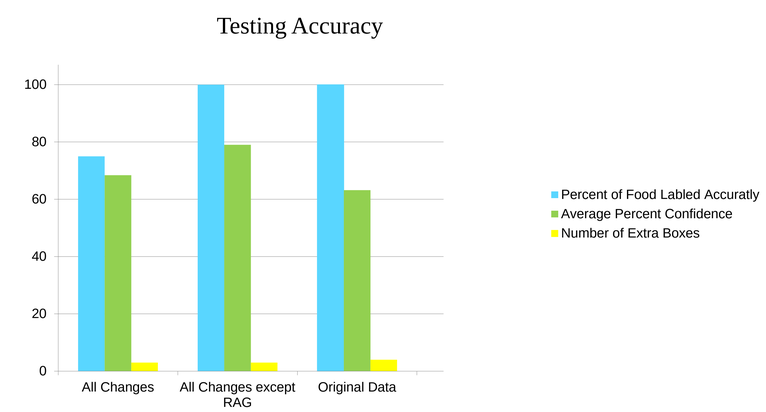
Manipulation of spatial organization and image content.

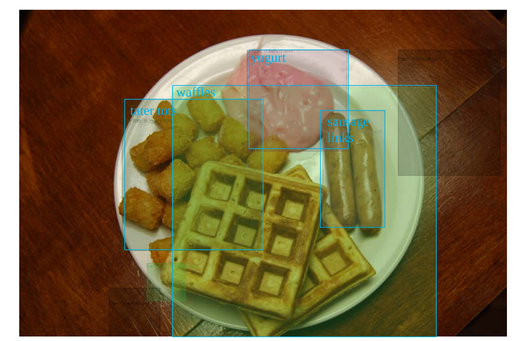
Output Images



- We created images with both white and noisy backgrounds
- The training set with noisy backgrounds ended up with a lower accuracy so it was removed

Results – Test Accuracy Increased





Test image with best overall accuracy was from the data set with no RAG.

Conclusion

Training data was successfully collected and 200 original images were turned into approximately 7,000 training images. The convolutional neural network was trained but needs to continue to be worked on to improve accuracy. This study found that artificial noise and food occlusion were not beneficial to the CNN's learning. The app proposed to go with this program has not yet been completed.

Acknowledgements

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