

Capstone Project Proposal

Problem

An AI-powered refrigerator monitoring device is a tool that can simultaneously help the environment and save time and money for millions of Americans. Today, 365 million pounds of food is [wasted daily](#). Americans are throwing away 15-25% of the food they [purchase](#), which equates to around 400 pounds of wasted food per person, per year. The most commonly [wasted food items](#) include bananas, strawberries, apples, bread and milk.

In a survey conducted by [OnePoll](#), 73% of the respondents felt guilt about the waste and 77% attributed tossing items because they forgot or lost track of the food amongst the clutter in their fridges. This food waste results in not only a loss of time and money on the consumers part, but also has [serious environmental impact](#): food production takes 10% of the total US energy budget, 50% of US land and swallows 80% of all the freshwater consumed in the US. When around 40% of the food produced in the US goes uneaten, that means that the energy, land and water is also wasted. Alongside that, uneaten food leads to packaging waste, as most food we buy come wrapped in plastic, in boxes or in styrofoam trays.

Currently, there are a lot of solutions that tackle adjacent issues, but none that evaluate this problem and its impact as a whole: there are numerous meal prep kit startups, food delivery options, articles on how to effectively meal prep to save time and waste, and even a \$5,800 [smart fridge](#) that lets you manually log what items you have put inside it. However, the meal prep kits [contribute to food](#) and packaging waste. Food delivery alone is not enough to prevent food waste and can even lead to more carbon emissions as Americans order food that they may not actually need or will not use. Above all, the closest solution, Samsung's smart fridge, is inaccessible to many Americans because of the lofty price tag (and because many of us do not want to or need to replace our fridge, which can *also* lead to a lot of unnecessary waste).

A refrigerator monitor, a small device equipped with a camera and computer vision capabilities, can keep track of what is inside the fridge and how long the food has been in the fridge. This can monitor the amount of food and alert the user when a particular produce is going bad. A future release of this product will allow for automatically ordering food that has run out and warning the user against buying food that is frequently thrown out, which will save the consumer time and money, as well as help the environment by preventing waste of important natural resources. This small device is affordable, futuristic and can be easily installed in people's fridges to help them save their time and money, while also lending a hand to the environment.

Data + Approach

To create this AI-powered device, images of frequently thrown out produce will be collected from Google Images using legal [web scraping](#) and any [relevant APIs](#). The images will be as clean as possible, to allow the algorithms to quickly extract relevant features (meaning, any background colors or images will be removed if needed, or only images with minimal background noise will be selected). Images of bananas, strawberries, apples, bread, milk,

blueberries, spinach, meat and yogurt will be collected and labeled because they are the most frequently thrown out food items in America. Around 1 million samples will be extracted from the web. Each food item will have around 10,000 images each to provide enough data for deep learning methods. The training and testing set split will be 50% training, 50% testing. Both machine learning and deep learning algorithms will be applied to compare the accuracy and efficiency between the two different paths and gain a full understanding of both machine and deep learning. Supervised machine learning classification algorithms, such as either a SGD classifier or a K-Nearest Neighbors classifier, will be created as an initial model. Deep learning, specifically computer vision through feature extraction and neural networks, will be used to classify the images and create the final product.

Product

The final deliverable will be a web app which uses a database of image samples (meant to model what would happen once the fridge monitor has been installed and the camera has taken around 1 million captures of the food inside the fridge). The web app will provide an interface that the user can interact with when they would like to know what is inside their fridge and how long it has been inside the fridge. The web app will display labeled photos of what is inside the user's fridge, alongside timestamps to help show how long the food has been in the fridge.

Requirements

I will need around 4 GPUs to be able to use TensorFlow and PyTorch for neural networks with deep learning. I will use the available GPUs that the classroom provides through AWS and Paperspace, and will work with my mentor if I need more memory or GPUs to sufficiently complete this project.

Conclusion

This project aims to apply AI techniques in order to build the software component for a theoretical fridge monitoring device that could save our natural resources and prevent wastage of uneaten food. Deep learning, specifically computer vision, will power the software in this device so that the computer will be able to read images of common wasted food in the way that a human would. While it is a simple solution, this software can solve a major problem that is contributing to the environmental crisis we see today.