Note: Dates in my log book is when I finished that certain task

9/24/2024

Finding Topic

Pollution is a problem this planet is facing, humans tend to put garbage in wrong bins and this leads to bigger problems because even the recycled items, if they are put in the wrong bin, will end up in the landfills. This is why Today I decided that I would make an innovation that is a garbage classifier that can sort trash using python code. My question is, Can a garbage classifier positively affect the environment by ensuring that waste gets sorted properly.

10/2/2024

Hypothesis

Today, I have come up with a hypothesis (an educated guess of my question). My hypothesis is: If I make a web-based garbage classifier, it will have a positive impact on the waste problems our planet is facing. Humans tend to put trash in the wrong bin, and all waste (recyclables and compost) ends up in landfills. This has a negative impact on the environment and makes it difficult to sort it out in the final stage. Making sure our waste is disposed of properly would decrease the waste in landfills.

10/8/2024

Background Research

- I have come up with my first 2 background research questions and have made my first one. My first question is the trash levels today. I have lots of quantity sources from this question.

- I have finished my first background research question, this is it:

In Canada, there are too many people putting trash in the wrong bin, most simply out of laziness to put it in the right bin or just not knowing which bin it goes in. 84% of households put things in the wrong bin. This is costing recycling programs around the country millions of dollars. One in three pounds (0.45kg in 1.36kg) of trash put in the recycling bin actually shouldn't be there. Cities in Canada with very dirty recycling (Edmonton and Toronto) can have contamination increases by 25 percent. It's very expensive to process contamination as recycling, it can even cost up to $4 million for a city to do this. All this has become a big issue because China, which is the biggest importer of recyclables, banned importing 24 different types of waste to prevent environmental disasters in the country. One of the waste items they banned from importing was paper and this became a problem for the rest of the world. "Something as simple as a piece of paper with a coffee stain on it, that piece of paper a year ago would have been recyclable, Today that's actually garbage". These are words from Jim McKay because of the China importation ban.

10/22/2024

Background Research

- Today I did my second background research question, which is recycle stats:

- In Calgary, 80 percent of what's in the recycling bin is recyclable, the other 20 percent is contaminated. Everything that is recycled goes to a factory to get sorted out. It goes through many stages before finishing. 70 percent is sorted by machine and 30 percent is manually sorted out. To remove metal, there is a large magnet that picks all the metal up and removes it from the lines. It also sorted out all the other recyclables like glass, paper, and cardboard. Whatever the machines left are then manually sorted leaving only materials that aren't recyclables. There are some flaws though, anything like styrofoam, large scrap metals, or garbage can interfere with the machines and cause them to not work. In Toronto, 70 percent of items in residential recycling bins are recyclable, while 30 percent are contaminated. That is 10 percent more than Calgary.

10/25/2024

Background Research

- I have finished my third background research question, what can and can't be recycled:

- Plastic usually cannot be recycled, but if it is stretchy like grocery bags or bubble wrap, then it can! Containers made of plastic are also recyclable, a case where plastic wouldn't be recycled is if it's crinkly like a chip bag. If containers are made of tin, then they can be recycled, as well as tin foil and pop cans. Glass can also be recycled, in the factory, it will be crushed and shipped to companies to make new products. What can't be recycled though is household items such as small appliances, trays, furniture, or lightbulbs. Toys and sports equipment can not be recycled either, along with clothing or shoes. Styrofoam will damage the machines in the factories so they cannot be recycled. Lastly, no hazardous materials as it is expensive to decontaminate.

10/28/2024

Background Research

- I have completed my fourth background research question and trash segregation problems today.

- This is my paragraph:

- The main reason I am doing this project is because of trash segregation problems. This is a problem because dangerous stuff like needles, dead animals, and bear spray are put in the recycling and it costs Canada lots of money to decontaminate them and all that money is wasted because it all ends up in the landfill either way. It costs Canada millions of dollars to decontaminate and segregate trash. Calgary's contamination rate for residential recycling is 13% of all of Canada and the only cities with a higher

contamination rate are Edmonton, Toronto, Halifax, and Fredericton. Toronto's contamination rate is the highest at 26% because trash segregation is the worst over there. This is all just because of people who put the wrong things in the recycling, the process of sorting trash and decontaminating items thrown in the wrong bin costs a lot more than we would expect. In Toronto itself, it costs about $600,000 - $1 million per year, that's a lot just to decontaminate trash. This is why segregating trash is very much needed and otherwise Canada is going to keep wasting money on just segregating trash.

- I have also decided what my fifth background research question is going to be, what is machine learning?.

11/1/2024

Background Research

- I have done my fifth background research question today,what is machine learning:

- Machine learning is a strong sense of computer science that uses data algorithms to enable AI. Machine learning slowly and gradually learns from its mistakes and improves its accuracy. Based on input data, machine learning will give a prediction, and will produce an estimate of patterns in the data. In my case, it will use an error function, where it identifies a margin of error to decide how accurate the following piece of trash is to the picture stored in the image library. Machine learning is adapting to human behaviors and trying to imitate them. It uses various image sources to define which segregation it belongs to, kind of like how we work, we see the trash with our eyes, and using previous knowledge, put it in the correct segregation. That's how it learns over mistaken attempts, when it makes a mistake, it will acknowledge that and fix it, just like humans!

11/15/2024

Planning Sheet explanation

- Today I did my sixth background research question, what is python and streamlit:

- Python is a form of coding language, it's very advanced and already has a lot of functions built into it. I will be using this to code to tell what I want my dustbin to do, and when to do it. I will also use classification where I will classify which segregation the piece of trash will end up in. Streamlit is a Python framework that delivers database apps with a few lines of code. It is what shows on the front end and is controlled with code in the backend. Streamlit creates data science apps mainly for machine learning. It's a Python library that gets created fast without knowledge of web development.

11/19/2024

- Today I have completed my seventh and last background research question, What is tensorflow:
- Tensorflow is an open-source platform that software developers use heavily. It is mature in deep learning frameworks and can develop advanced models. It can be used to train models and datasets to make it easy to classify items. Tensorflow is based on machine learning and the accuracy increases after the model training. The framework will input the data as multi-dimensional arrays (arrays with more than one dimension), these are called tensors. It is used for many tasks, such as image recognition, language processing, handwriting recognition, and certain equations.

11/23/2024

Procedure

- Today I wrote my procedure on how to install python on a windows 10 computer as python is needed in my project.

- This is my procedure on how to install python:

- With a windows 10 computer, go to the python website (python.org)
- On the homepage there will be a spot saying “Download the latest version for windows” and below that is a button saying “Download python” and the newest version, i am using version 3.11.4 but download whatever the newest version is.
- Once it has downloaded, click the exe, this will open up the install prompt. Before clicking install make sure to look at the bottom of the prompt and check the box that says “Add python to PATH” and then click install.
- Wait for python to install and once it's done, close the install prompt.
- To make sure that you have python installed go to the windows command prompt by searching it in the windows search bar which is left of the taskbar.
- When you're in the command prompt, type this, “python --version” (make sure to have one space between “python” and the first dash and no spaces between the two dashes and “version). It should look like this:
- ```
  python --version
  ```
- If you did everything correctly it should respond with the version of python you have, and this means you have successfully installed python to your computer!

11/25/2024

Procedure

- I have written a procedure on how to install python on a windows 10 computer, but we need an efficient place to write that code. I could write it in the python terminal but it is way more organized and clean in an IDE (Integrated development environment). So this
  ```

procedure is on how to get the IDE I used which is visual studio code. This is an IDE made by Microsoft and is completely free.

- This is my procedure on how to get an IDE (visual studio code):

- To get visual studio code (the free IDE I am using) we first have to go to the website, code.visualstudio.com.
- On the main page click “Download for windows” (stable build).
- When the download is complete, click on the exe which will bring you to the setup process.
- Click on “I accept the agreement” and click next.
- Go with the default location and click next until you get to “select additional tasks”, make sure to tick all the boxes on this page then click next.
- On the final screen hit install.
- Once the installation is complete, then click on finish on the last screen, make sure that the box saying “Launch Visual Studio Code” is checked before you click finish.
- If you did everything correctly you will be dropped in visual studio code and on the welcome screen. If you want to go back to this screen, click the help button and go to welcome.
- Before we can code, we need to install python to visual studio code, go to the left and look for the extensions icon, this is what it looks like:

- Click this button
- In the search field above the pop up that shows once you click on extensions, search “python”.
- Click on the top option and check if it is by microsoft, if not select another until it is.
- Click on install.
- When python is installed, we need to select an interpreter which is going to be the python version you installed. To do this click “Ctrl Shift P” at the same time to open the interpreter search field.
- Search “python: select interpreter” and click the option available.
- Then it will show the version of python you have installed and click on that.
- Once you have selected the version of python as your interpreter, you are all set to start coding on visual studio code!

12/14/2024

Method

- Today I Have created my method, here it it:

1. Importing libraries and tensorflow in vs code
2. Data Importing
3. Data Visualization

4. Preparing the data
5. (Transforming raw data to be read accurately when analyzed)
6. Importing OneDNN
7. Model Creation
8. Model Compilation
9. Train the Model (batch_size = 32, epochs = 10)
10. Testing Predictions
11. Save the model

- I will talk about what everything means in my presentation

12/16/2024

Application code

- I finished the code that will provide all the display and options in my application that runs my streamlit. The application opens and works nicely. I was thinking about doing some test trials and plotting a graph on the accuracy of my classifier.

- This is some machine learning I used in my code:

- I used machine learning in python coding in my project. Numpy is a package which is fundamental for scientific computing just for python. It is a Python library that provides a multidimensional array object, different derived objects, and an assortment of routines for fast operations on arrays. It also has mathematical aspects like logic, shape manipulation, sorting, selecting, basic linear algebra, basic statistical operations, etc. I also used PIL (Python Imaging Library) which is a library to store my Images. I also used urllib.request. This module is used to define functions making it easier in opening URLs; opening URLs is one of 2 options to upload an image onto streamlit. Tensorflow and keras are also used. Keras works with tensorflow; it simplifies the difficulties linked with deep neural networks. Tensorflow and keras will help train my model. Along with tensorflow, I am using OneDNN. It is an advanced library for deep learning that is made for optimizing the performance of deep neural network computations.

12/21/2024

Analysis

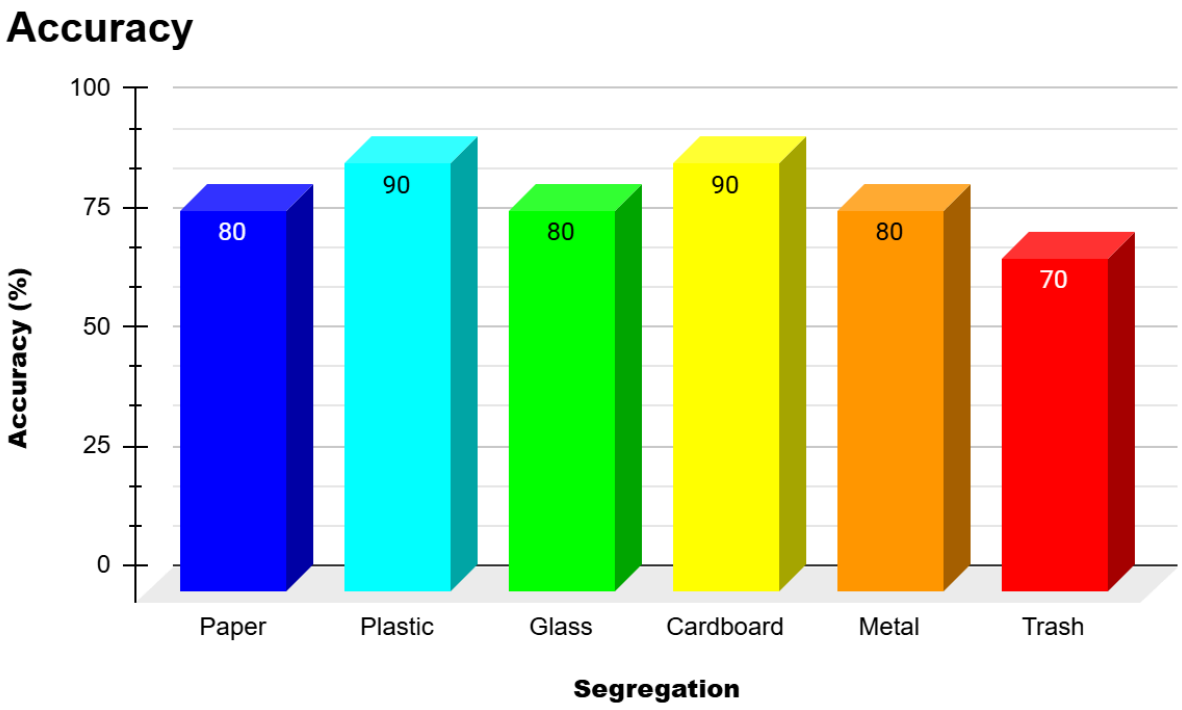
I did 10 rounds of each category to see the accuracy. Here are the results:

- Paper 8/10
- Plastic 9/10
- Glass 8/10
- Cardboard 9/10
- Metal 8/10

- Trash 7/10

Plastic and cardboard did the best as cardboard is very similar to most images, the only time it messed up, it got confused with paper. This isn't the biggest deal though because both paper and cardboard are recyclable. Plastic has similar shapes especially when it comes to plastic bottles. Paper got mixed up with cardboard a couple of times; glass got mistaken for plastic, and metal got confused with glass and plastic. Trash did the worst because there is such a wide variety and I only have around 150 photos for it. Overall, it got a score of 49/60, Meaning in 60 rounds, it got a 78.34% accuracy.

- My graph:



- Extension before CYSF: Before the cysf fair, I will extend on one thing that will affect this current analysis. I will add more pictures to my database. This means that there are more images to compare to, also meaning that the accuracy will increase.

12/26/2024

- Today I completed my conclusion, here it is:

- My hypothesis is correct, my project if expanded would almost always correctly segregate trash at the source level. This will reduce the upstream sorting cost and less waste to reach landfills. So indeed this would benefit the environment, human health, and the economy. Proper waste management can also reduce pollution, prevent the spread of diseases, and conserve natural resources.

1/2/2025

- Today I completed both my sources of error and my real world applications.

- Here are my sources of error:
  - It wasn't completely accurate - I have many photos in my dataset, but there will always be new angles or orientations that I do not have, therefore not making it 100% accurate
  - I could have made a physical model - I made it web-based meaning I need to use images online or already saved images, it would be more efficient if it could take a picture in real-time and compare it to my dataset.
  - Every time I needed to load my application, I would have to type "streamlit run app.py". After that, it would take a long time, approximately 2 minutes to load, meaning that it isn't very fast and efficient to work with.

- Here are my real world applications:
  - Would decrease the amount of unwanted trash in landfills - So many people put the wrong trash in the wrong bins, this project makes it so even if people are lazy, everything will be segregated properly. With rates going so high to decontaminate recycling from garbage (up to $4 million), then I think that at this point, we have to try something else. And not only is it in landfills, countries with poverty and no access to a proper way of disposing trash, it all just ends up on the streets, so if this project is expanded, it needs to be accessible for all countries, and would make a huge difference on these people's lives.
  - Cost efficiency - Costs would go way down, there would be such a small amount of error if this project gets expanded for the trash to segregate incorrectly. Making it less decontamination, meaning also less money wasted. Even though the cost would go way down, it won't be nothing. There will still be some people that would be too lazy to put trash in a machine that does the work for them or they're not near a machine.
  - To show change - If this can help the world, many years from now people will see the change that has occurred and realize how much damage and harm they have done to the planet. The huge difference from then and now. Maybe then, people might become better people in general.
  - Relief to recycle factory people who knew how bad things were - These people are probably one of the only people who would actually know how bad things were exactly. This would give them relief knowing that the world could be in better hands.

1/3/2025

- Today I finished and cited all my sources in APA format