Classifying Recyclables Rubric

1. General Description

The Recycling ML Project challenges students to develop a machine learning (ML) model that classifies waste items as recyclable or non-recyclable. The project aims to address a critical issue in U.S. waste management, where over **85% of plastic waste** ends up in landfills. Your goal is to design a model that accurately predicts the category of waste items using image or tabular data.

The deliverable is a comprehensive machine learning solution that demonstrates a clear understanding of model development, evaluation, and interpretability. The project incorporates both technical rigor and creative problem-solving, allowing students to apply their knowledge of ML techniques, data processing, and ethical AI considerations.

This rubric outlines the key components for successful completion of the project and defines how each aspect will be evaluated.

2. Purpose

The purpose of this project is to enhance students' understanding of machine learning for real-world environmental challenges. By working on waste classification, students gain experience in data preprocessing, feature engineering, model selection, and evaluation. Additionally, students will engage in responsible AI development by considering model fairness, explainability, and the potential societal impacts of their solution.

This project offers students the opportunity to produce a tangible, impactful deliverable that addresses an urgent environmental issue. Successful completion will demonstrate a student’s ability to tackle complex, unstructured problems and produce a viable machine learning solution.

3. Task Overview

Students will:

1. **Data Collection & Preprocessing**: Identify, clean, and prepare a dataset of waste items, which will be composed of image data.
2. **Model Development**: Design, train, and evaluate an ML model to classify waste items as recyclable or non-recyclable.

3. **Model Evaluation**: Measure model performance using key metrics (e.g., accuracy, precision, recall, F1 score) and consider ethical AI principles, such as bias and fairness.
4. **Technical Report**: Document the problem, methods, findings, and results, clearly presenting the logic behind model choices to an audience.
5. **Presentation & Code Submission**: Provide all relevant files, including code, datasets, and documentation, in a GitHub repository.

When will I know I have Succeeded? You will meet expectations on CS3 Create Case Study when you follow the criteria in the rubric below.

Spec Category	Spec Details
Data Collection & Preprocessing	The student effectively sources, cleans, and prepares the dataset for training. Missing data, outliers, and any imbalances in the dataset are addressed. Students must provide clear evidence of data exploration and cleaning in the technical report.
Model Development	Students must build at least one classification machine learning model, selecting either a prebuilt CNN, a user created CNN, or any other type of deep learning technique able to make decisions based upon image data
Model Evaluation	The student evaluates the model performance based upon their accuracy, validation accuracy, and loss values. The student must also report on what their performance indicates, make a report on how they could improve performance, or what their current performance indicates.

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