Project Proposal: The Future of Recycling

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Project Pitch

Business Understanding

Problem Statement

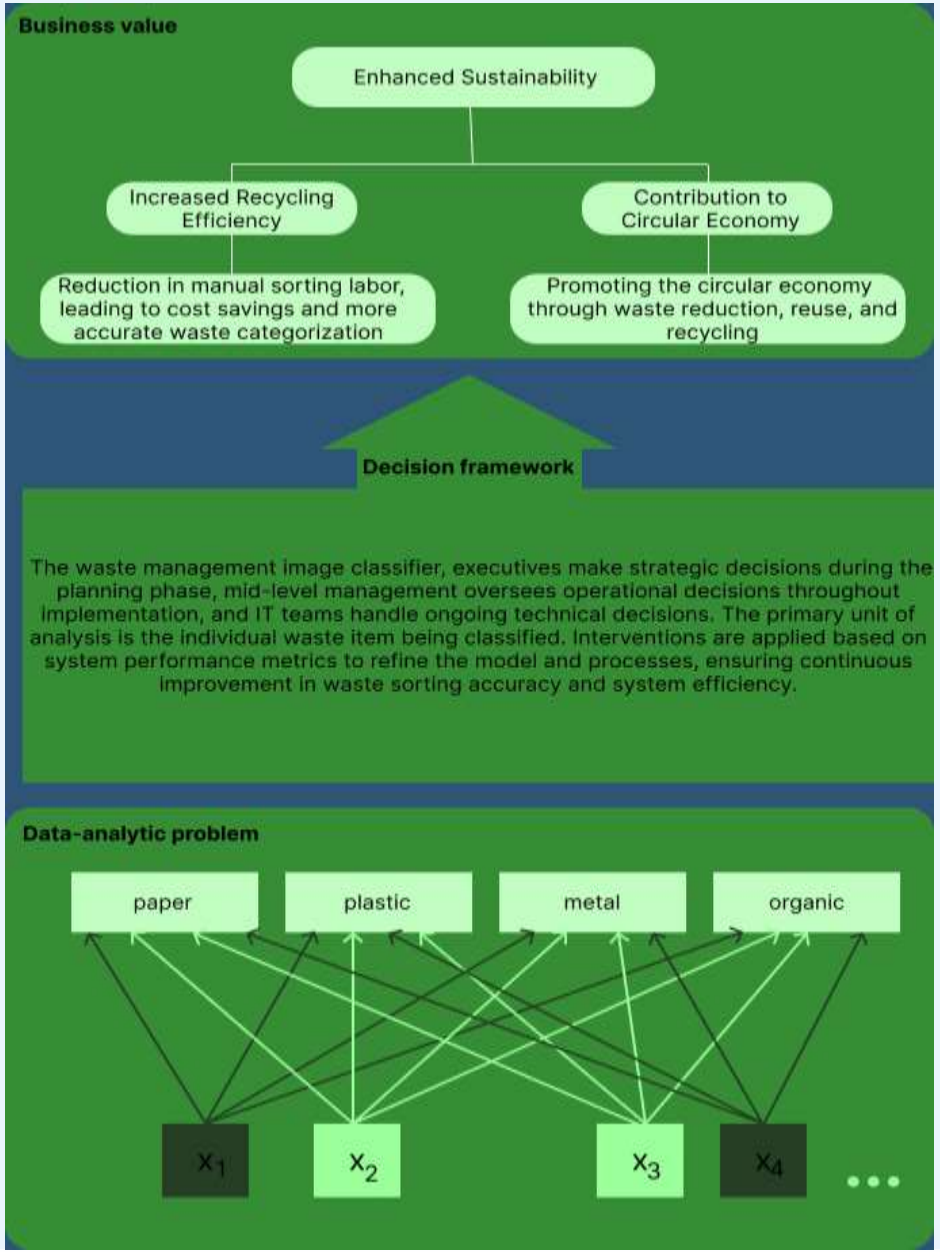
- Inefficient waste management and its impact.
- High costs and environmental damage due to poor recycling practices.

Main Stakeholder and Needs

- Stakeholder: Management.
- Needs: Efficiency, cost reduction, sustainability, and regulatory compliance.

EcoScan Application

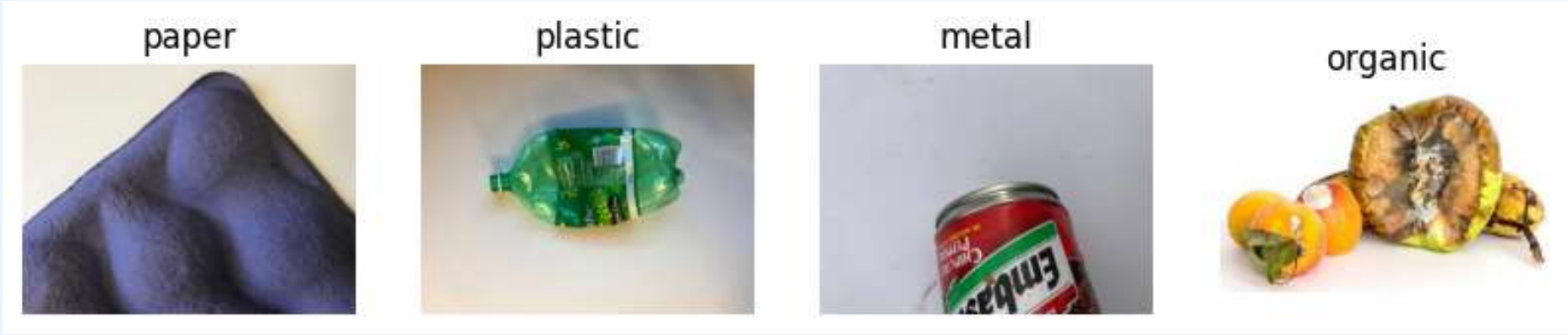
- Real-time waste material classification
- Features: Waste image classification, educational content, recycling locator, and community challenges.



Problem Overview

Deep Learning

- The model is designed to classify waste materials into distinct categories for proper recycling.
- It has 4 classes:
  - Paper (182 images)
  - Plastic (141 images)
  - Metal (164 images)
  - Organic (132 images)



- The accuracy of the baselines:
  - Random guess (25%)
  - Human-level performance (100%)
  - Basic MLP (32%)

Model Overview

Deep Learning

Development Journey:

- **Iteration 1**: Normalization, CNN with three convolutional layers, CNN, Training accuracy (**90%**).
- **Iteration 2:** Data Augmentation, CNN with a dense layer with batch normalization and ReLU activation, Training accuracy (**90%**).
- **Iteration 3**: ImageDataGenerator, CNN TensorFlow's Sequential model framework, Training accuracy (**99%**)
- **Iteration 4**: VGG16 architecture, pre-trained on ImageNet, Training accuracy (**59%**)

Performance Breakthroughs:

- **Data Augmentation**: Key for reducing overfitting.
- **Batch Normalization & Dropout**: Stabilized training and further combated overfitting.
- **Pre-trained VGG16**: Significantly enhanced learning capability and accuracy.

Final Model Architecture:

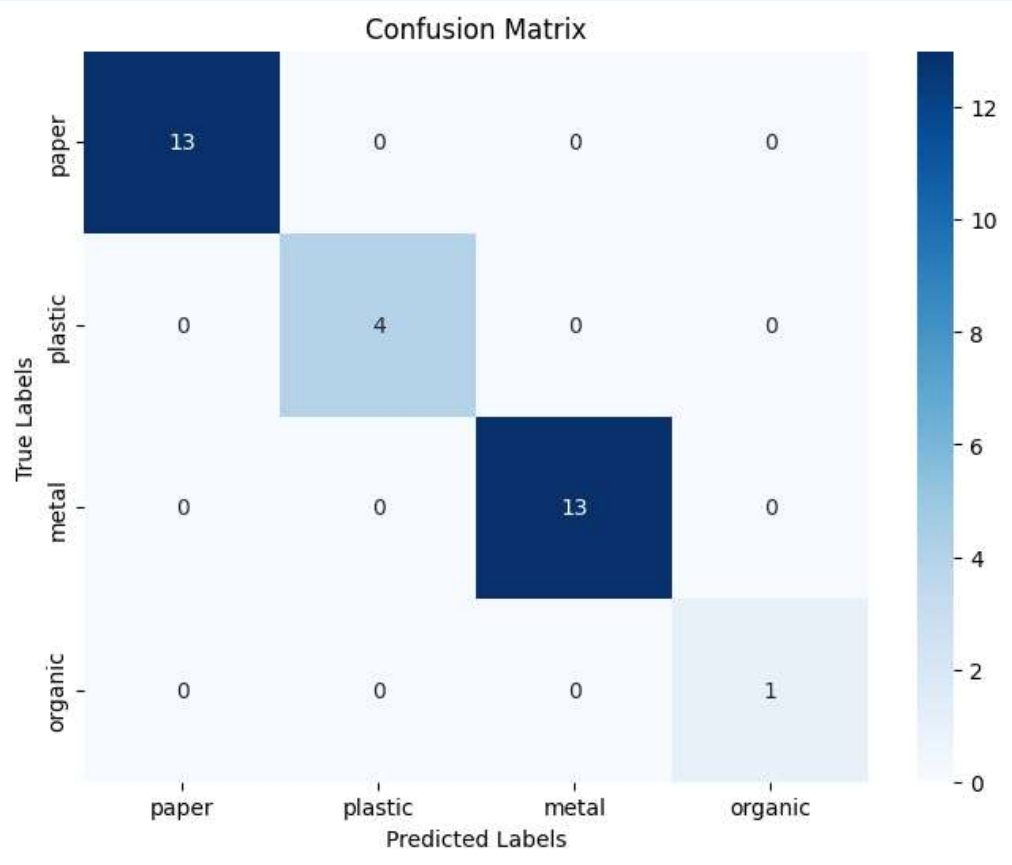
- **Base**: VGG16 (frozen), ensuring rich feature extraction.
- **Custom Layers**: Flatten, Dense(256, ReLU), Dense(128, ReLU) + Dropout(50%), Dense(4, Softmax).
- **Optimization**: Adam optimizer, with Sparse Categorical Crossentropy loss and Accuracy metric.

Model Performance

Deep Learning

- **Final Model Results:**
  - **Achieved Training Accuracy:** 99.75%;
  - **Validation Accuracy:** 69.7%.

x	Accuracy (%)	Precision (%)	Recall (%)	F1 Score (%)
Iteration 1	77	77	76	76
Iteration 2	31	19	31	23
Iteration 3	68	69	69	69
Iteration 4	67	55	61	56



Model Interpretability

Responsible AI

- **Priority: High Accuracy**
  - Essential for correct waste classification.
  - Direct impact on recycling efficiency and environmental sustainability.
  - Influences user trust and app adoption.
- **Secondary: Interpretability**
  - Supports user education on waste segregation.
  - Enhances user engagement and trust in the app.
  - Facilitates feedback for continuous improvement.
- **Balance is Key**
  - Main focus on achieving high accuracy.
  - Incorporate interpretability to boost user experience and education.

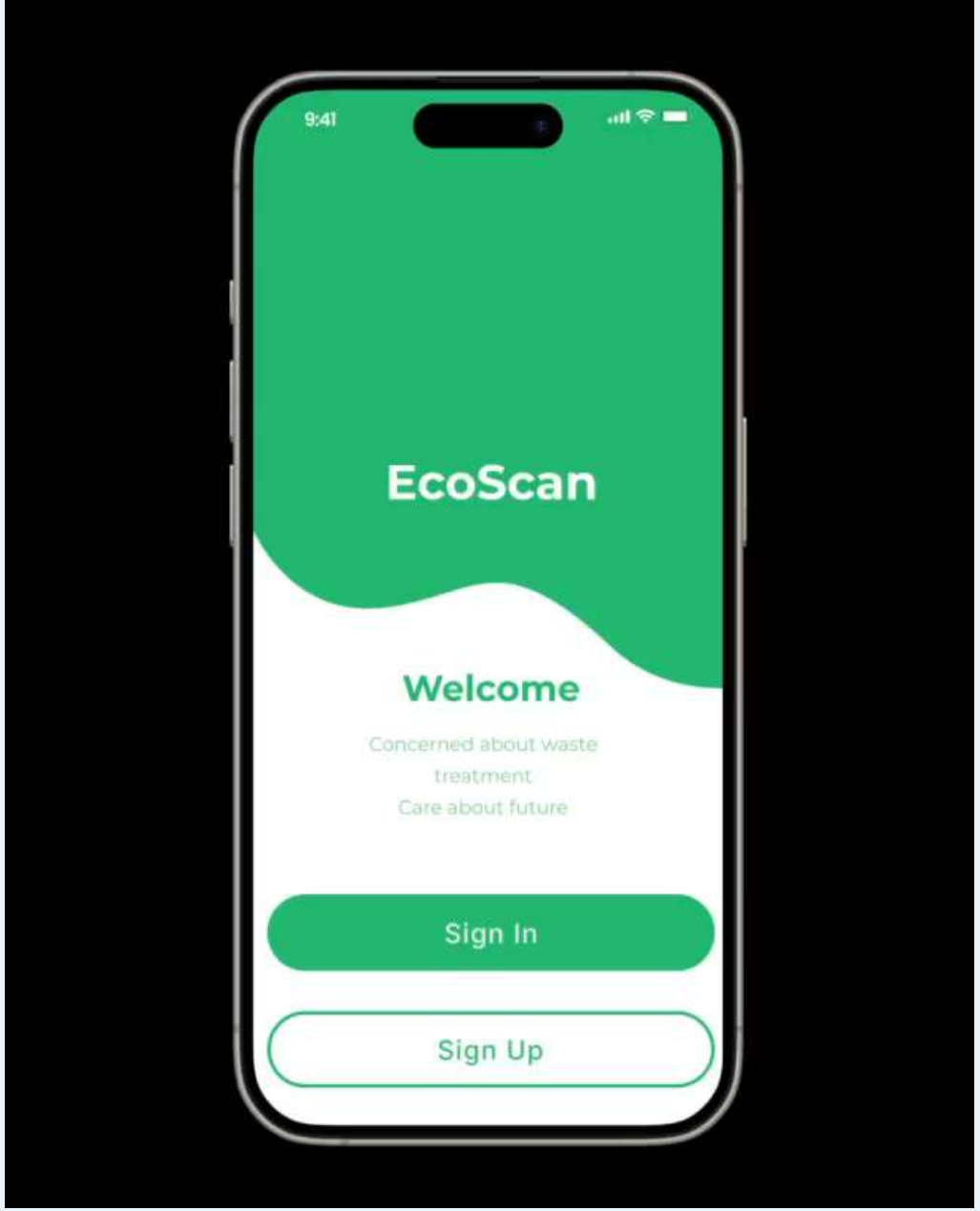
User Study

Human-Centered AI

- **Study Explanation & Hypotheses:**
  - Conducted a user experience study focusing on app navigation and search functionality.
  - Hypothesis 1: Simplifying the navigation menu will reduce user frustration and increase task completion speed.
  - Hypothesis 2: Enhancing search functionality will improve the relevance of search results and user satisfaction.
- **Incorporation of Results into Final Wireframe Prototype:**
  - Simplified navigation: Reduced the number of menu items and grouped similar functions together for intuitive access.
  - Enhanced search functionality: Implemented auto-suggestions and filters to allow users to refine their searches more effectively.
  - Both changes were directly informed by user feedback indicating confusion with the original navigation and dissatisfaction with search results relevance.

Demo

Human-Centered AI



Thank you!

Any questions?