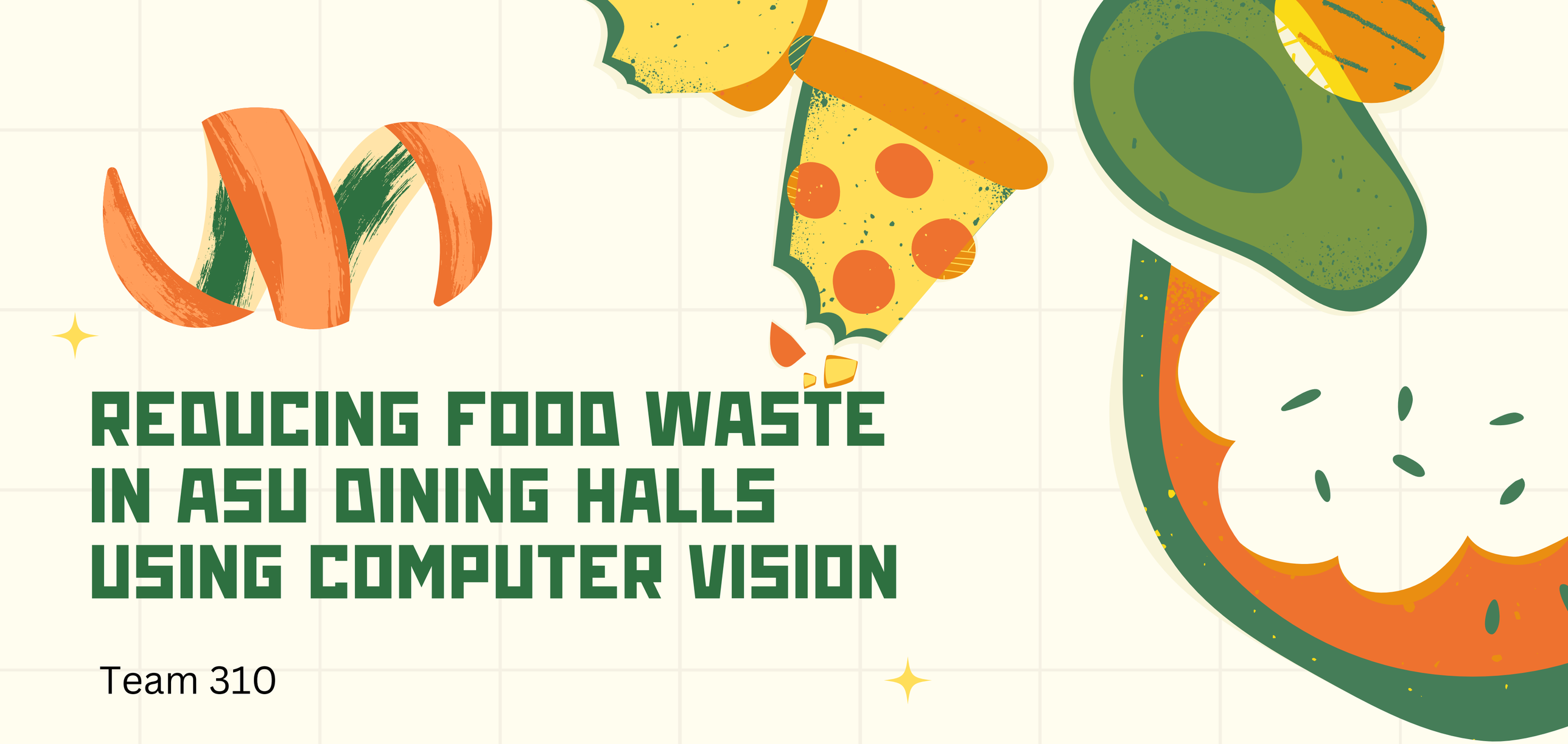


REDUCING FOOD WASTE IN ASU DINING HALLS USING COMPUTER VISION

Team 310

PROBLEM DEFINITION

- Problem: Large volumes of food waste generated daily at ASU dining halls
- Challenge: Inability to accurately measure what and why the food is discarded
- Data Gap: Transaction data ≠ actual food consumed/wasted

Why is it Important to

MANAGE FOOD WASTE?

- Economic Impact: Wasted food = wasted budget in procurement
- Sustainability: Food waste contributes to landfill overuse and greenhouse gases
- ASU Strategic Goals: Aligns with ASU’s Zero Waste Initiative
- Student Awareness: Encouraging students to reflect on waste behavior

STAKEHOLDERS & BENEFICIARIES

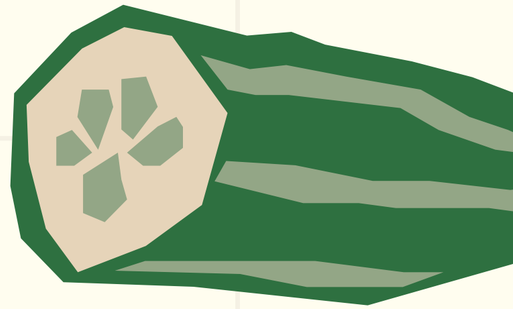
- ASU Administration - Cost savings and better sustainability scores
- Dining Services - Improved meal planning and reduced prep waste
- Students - Enhanced food variety and potential incentives
- Sustainability Office - Data to support institutional goals

CURRENT SOLUTIONS & ISSUES

- Current Solutions at ASU: Composting Programs
- ASU dining halls compost all food waste, as shown in the Memorial Union signage (12.73 tons collected as of Feb 2025).
- Issue
  - Composting addresses waste disposal after it happens, but does not prevent food waste from occurring in the first place.
  - Composting programs do not capture data about what types of food are wasted, student behavior patterns, or opportunities for proactive waste reduction.

COMPUTER VISION APPROACH FOR FOOD WASTE DETECTION

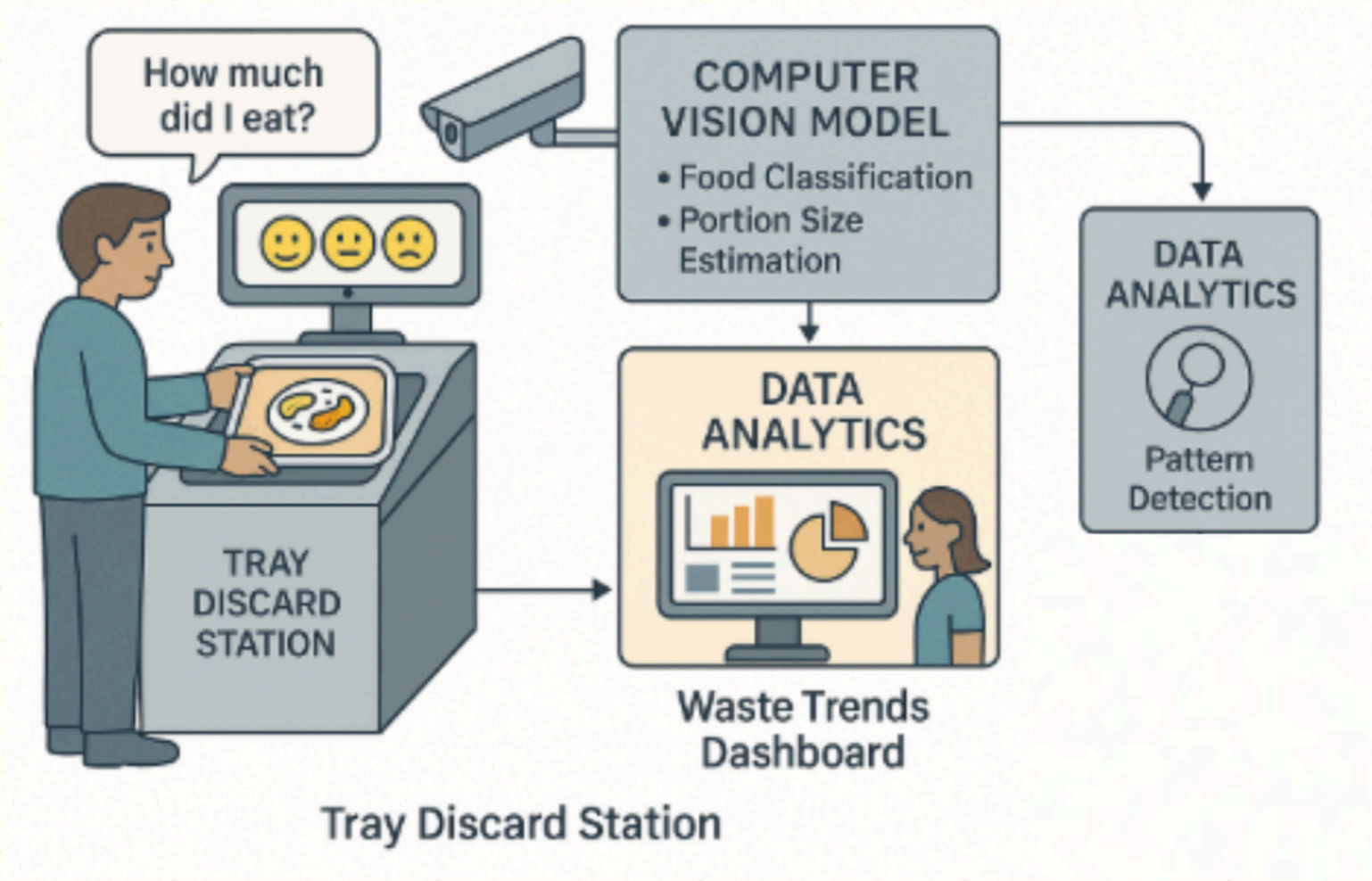
1. Cameras capture images of discarded food at waste stations
2. CV model classifies food and estimates portion sizes
3. Backend analyzes waste trends
4. Possible meal recommendations are given
5. Optional - Feedback from students are collected



WHY CV IS ESSENTIAL

- Automates Waste Detection: Removes human subjectivity and labor needs
- Scalable & Real-time: Supports instant feedback and longitudinal data collection
- Enables Personalization: Allows student-specific insights (if integrated with ASU ID/card scan)
- Without CV: Real-time tracking and classification would be nearly impossible.

END-TO-END PRODUCT SCHEMATIC



COMPUTER-VISION SOLUTION

- Problem Definition: Multiclass classification + regression for volume
- Data Acquisition:
  - Custom photos from ASU Pitchforks Dining Hall Tempe Campus
  - Annotation: Performed using CVAT
- Model Development:
  - Base Model: Yolov8m
  - Custom Training: Fine-tuned on ASU Dining Hall food waste dataset using bounding box annotations
- Validation
  - Confusion matrix for food ID accuracy
  - MAE for portion size estimation
- Deployment: Cloud deployment via Gradio app and streamlit hosted on Hugging Face Spaces.
- Post-deployment Maintenance
  - Regular updates with new food images
  - Feedback from staff to improve misclassification

COMPUTER-VISION SOLUTION

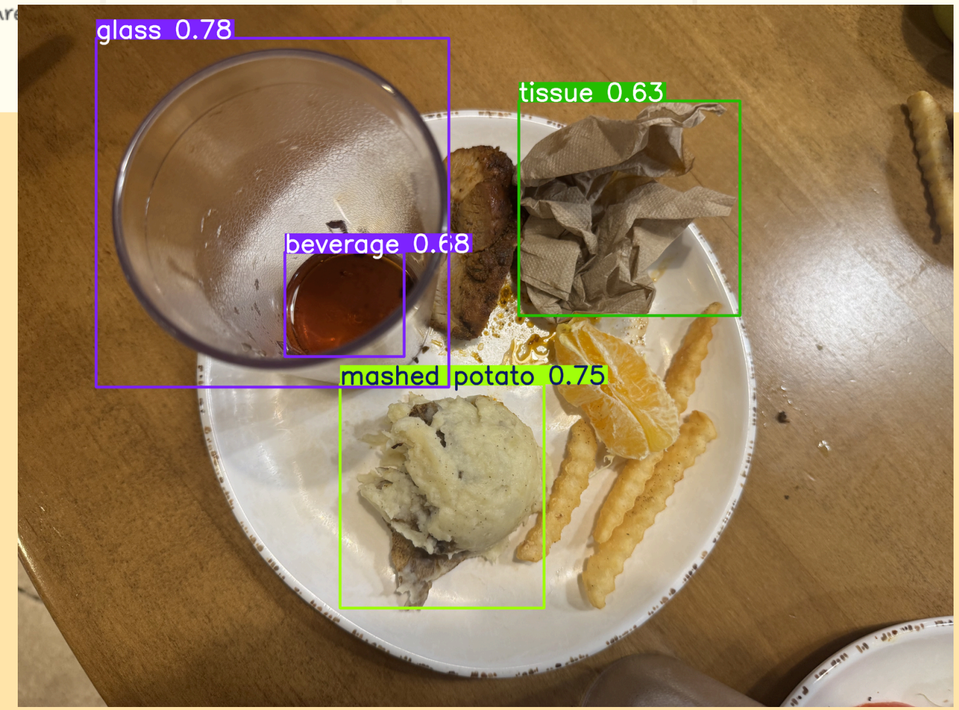
Food Waste Analysis Process

Fine-tuned model for food detection

Identifying and labeling food items

Calculating portion sizes based on ar

Compiling data into actionable insights



📈 Validation Metrics after Training:

Metric	Value
Mean Precision	0.4292
Mean Recall	0.475
mAP50	0.4905
mAP50-95	0.2169

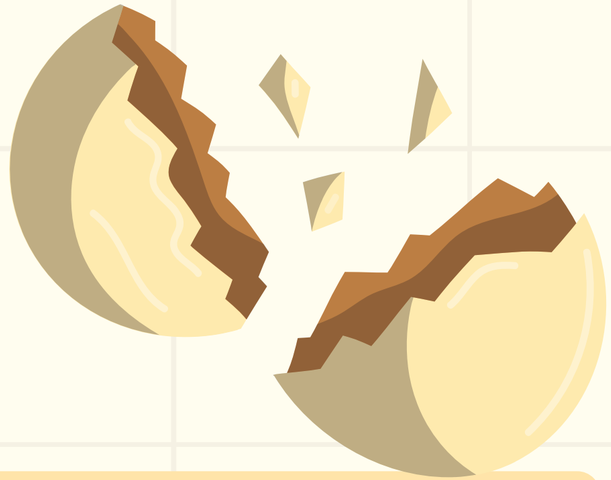
LIVE DEMO

Hugging Face : https://huggingface.co/spaces/Nishant1901/asu

Gradio Link : https://2bb15c329bbd309958.gradio.live/

Upload discarded food image or live scanning ➔ Get food type and estimated portion size (grams).

RISKS, LIMITATIONS, & MITIGATION

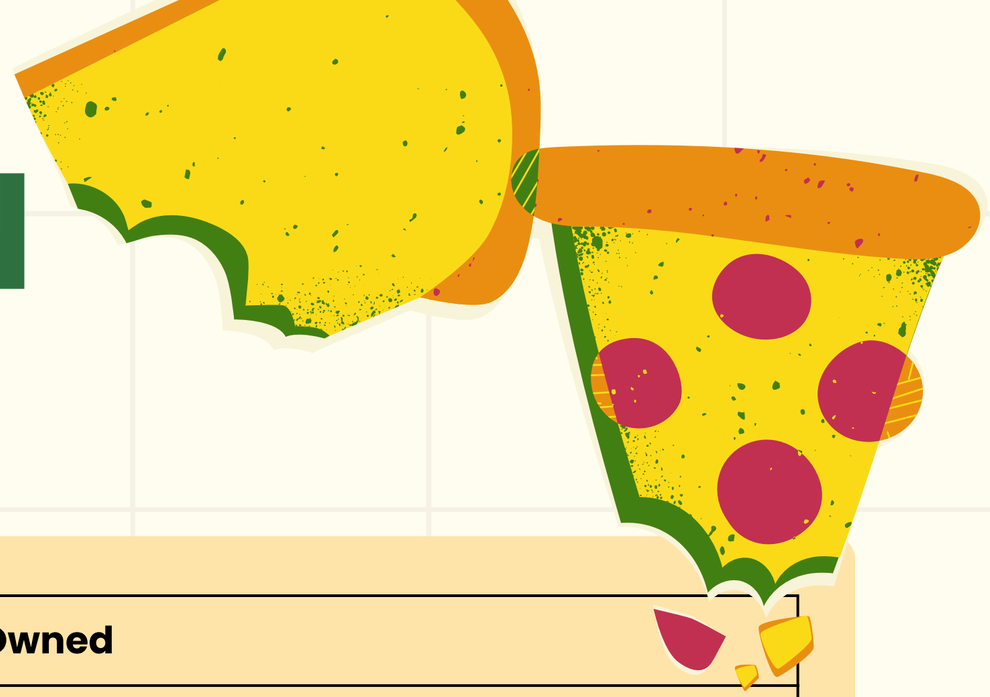


Risk	Mitigation
Privacy Concerns	No facial tracking; images processed locally and deleted
Data Accuracy	Train on varied data, use multi-angle capture
High Initial Costs	Pilot with existing security camera hardware
Model Drift	Continuous monitoring for model drift due to new menu items; retraining ed quarterly
Ethical Bias	Model tested across diverse cultural cuisines

CONCLUSION

- Reducing food waste is critical for economic efficiency, environmental sustainability, and achieving ASU's Zero Waste goals.
- Current composting efforts are valuable, but they treat the symptom, not the cause.
- Our Computer Vision-based solution provides real-time, scalable, and data-driven insights into food waste behavior.
- By empowering dining services with actionable data, we can reduce waste at the source, improve menu planning, and foster greater student awareness.
- Our project not only addresses immediate operational improvements but also lays the groundwork for a smarter, more sustainable campus dining experience.

TEAM CONTRIBUTION TABLE



Team member	Tasks Owned
Che An Chen	CV model research, Data gathering
Chip Tang	Proposal writing, Dashboard mockup
Hyeongju Gwon	Schematic diagram design, Final deck preparation
Nishant Nitin Gode	Dataset collection, Model training, Gradio & Streamlit interface development, Hugging Face deployment.
Reshini Suresh Kumar	Data cleaning, Data labelling and Data Annotation

REFERENCES

- Roboflow Food Waste Detection Dataset : https://universe.roboflow.com/jshort-college-harvard-edu/food-waste-detection-v2-fevnw
- Ultralytics YOLOv8 Documentation : https://docs.ultralytics.com/models/yolov8/
- Gradio: Build ML Web Apps : https://gradio.app/
- Hugging Face Spaces Overview : https://huggingface.co/docs/hub/en/spaces-overview
- CVAT Annotation Tool : https://www.cvat.ai/

THANK YOU