Automatic Building Footprint Extraction from UAV Imagery

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Project Overview (Phase 1)

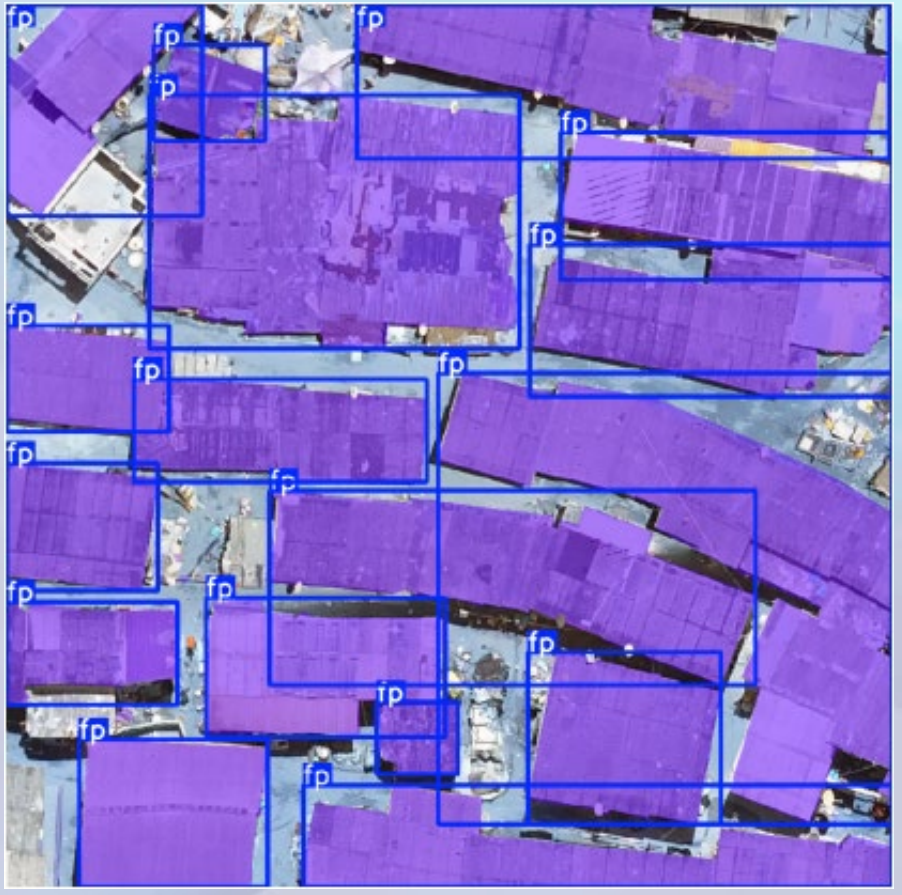
- AI-based extraction of **georeferenced building footprints**
- **Faster**, **cheaper**, and more **consistent** than manual digitizing
- Supports engineering, planning, AfDB water project needs
- Collaboration: **GeoAI Lab** & **Ghana Water Limited**

Data Preparation

- Orthomosaics chipped into **1024×1024 tiles**; each containing 5 – 30 buildings
- **Manual annotation** by 150+ students
- Quality control ensured consistency
- **Diverse roof types** and settlement patterns across Ghana

Model Training and Accuracy

- Instance segmentation model:
  YOLOv11
- 85% training data, 15% validation
- Validation (751 images):
  – Precision: **0.993**
  – Recall: **0.989**
  – mAP50: **0.994** | mAP50-95: **0.959**

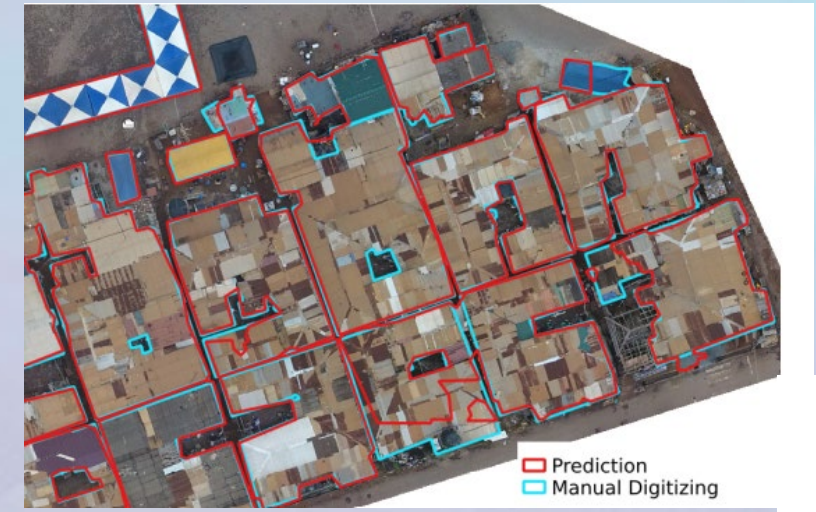


Inference Pipeline

Steps:

1. Tile orthomosaic
2. Segment chips using trained model
3. Polygonize + clean shapes
4. Output: **Shapefile building footprints**

Inferences:



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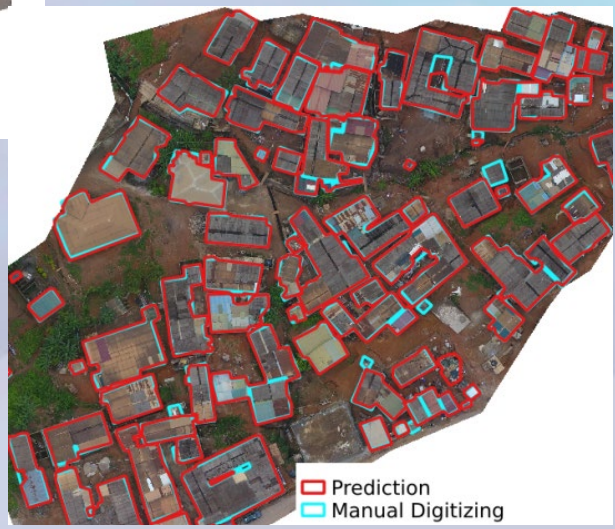
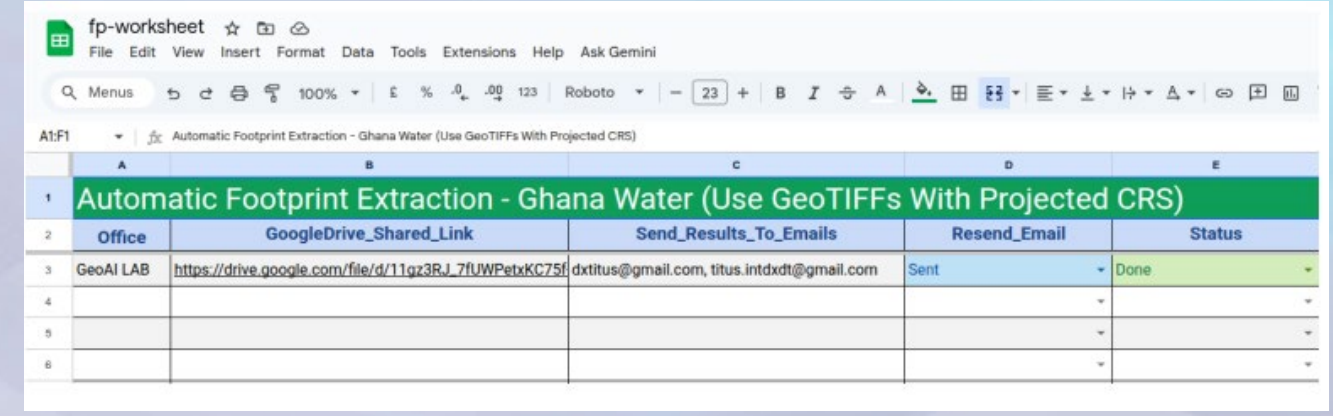


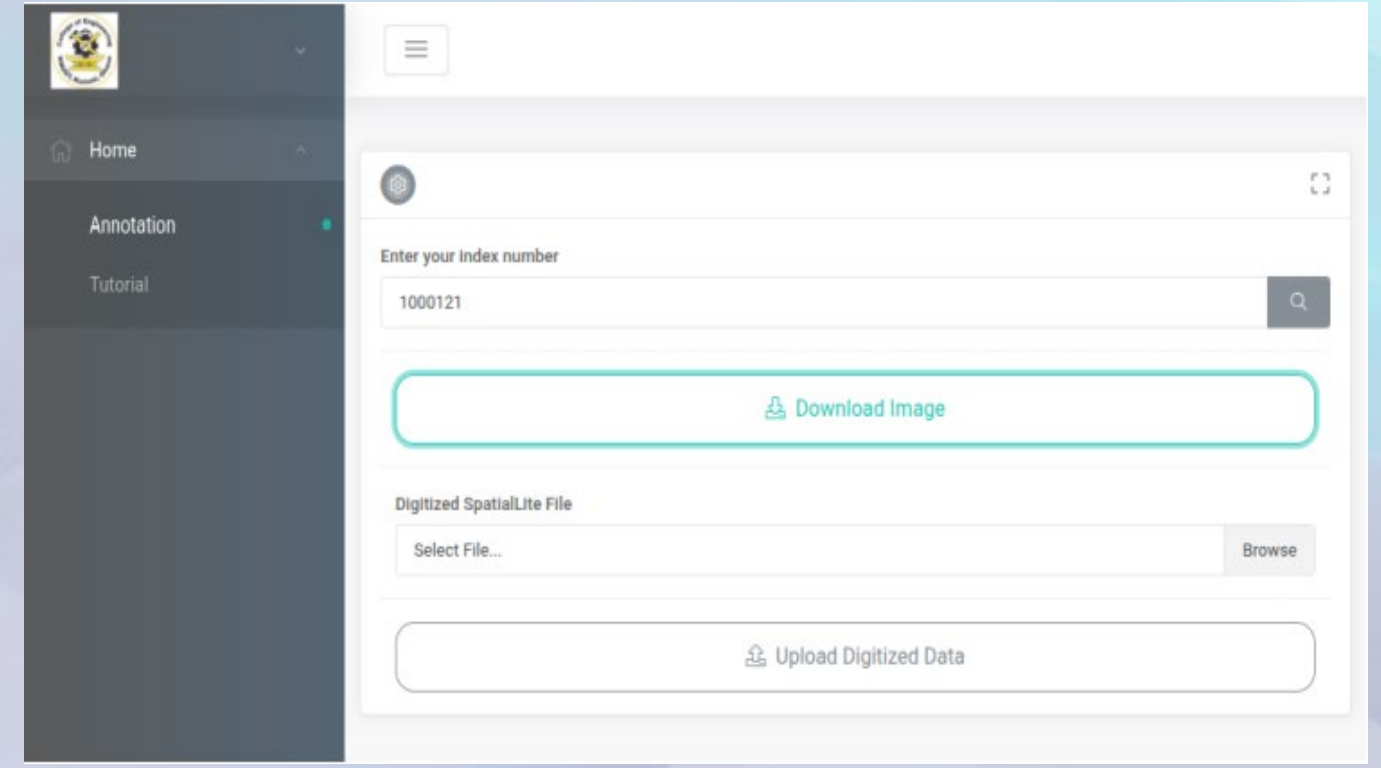
Benefits – Segmentation Service for GWL

1. Upload GeoTIFF to Drive
2. Submit link + email via request form
3. Receive shapefile via email
4. Enables AI mapping without technical knowledge



Benefits – Capacity building

- 150+ undergraduate annotators, 5 MPhil students
- UAV mapping, annotation, segmentation workflows
- Web-based annotation training environment



Future Work (Phase 2)

- Add classes: uncompleted buildings, buildings with concrete roofs, water tanks
- Improve polygon regularization
- Full-scale cloud inference service
- National deployment + stakeholder workshop

Conclusion

- Successful AI-assisted building extraction demonstrated
- High accuracy and consistent results across multiple sites
- Supports future national-scale geospatial automation

Thank you