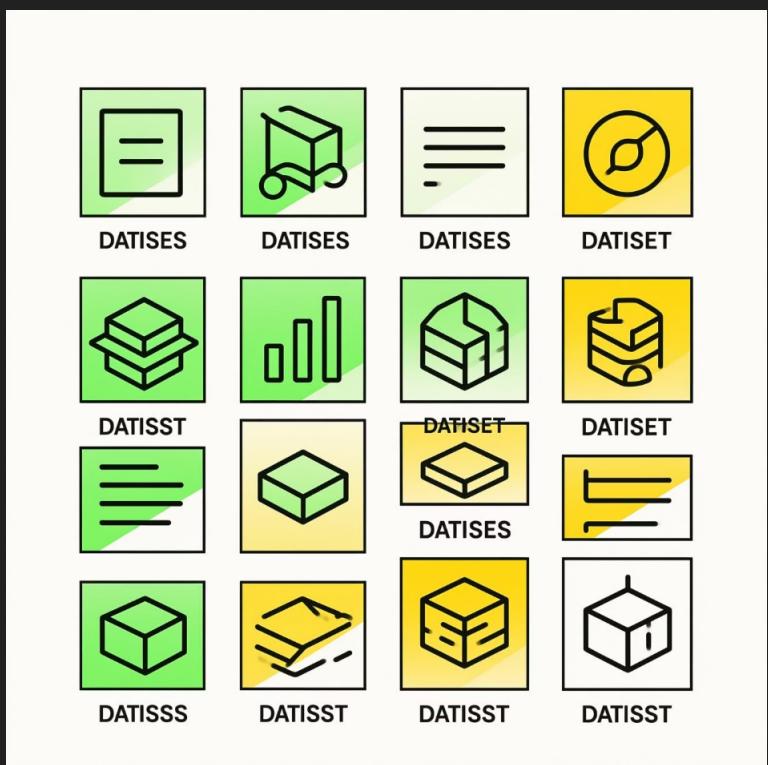


Project Complete – Evaluation Summary

Project complete: a full framework for evaluating traditional versus foundation models for segmentation. The simulated dataset contained 500 images across 21 classes with a 70/20/10 train/val/test split. This controlled setup enabled quantitative and visual comparisons that highlight trade-offs between accuracy, speed and generalisation.

Dataset Overview

Simulated dataset | 500 images | 21 classes | 70% train, 20% val, 10% test.



Model Overview



Traditional — U-Net

Fully supervised U-Net encoder-decoder trained on the target dataset for 10 epochs with early stopping. Optimised for the specific data distribution.



Foundation — SAM

SAM is zero-shot, Vision-Transformer based, pretrained on SA-1B ($\approx 1B$ masks). No training was performed on the simulated dataset; it provides universal segmentation capabilities.

Quantitative Results

The traditional model (UNET) outperformed SAM across core metrics on this dataset. Key numbers are summarised below to emphasise the scale of difference between a dataset-trained model and a zero-shot foundation model.

Metric	UNET / SAM
Accuracy	0.9139 / 0.0216
mIoU	0.2431 / 0.0038
Dice / F1	0.2905 / 0.0075
Precision / Recall	0.2828 / 0.3375 vs 0.0209 / 0.0628
FPS / Inference Time	397.88 FPS / 2.51 ms vs 1.96 FPS / 511.32 ms

Key Insights & Practical Recommendations



Accuracy vs Generalisation

Traditional models outperform on domain-specific data; foundation models excel zero-shot across domains.



Speed & Efficiency

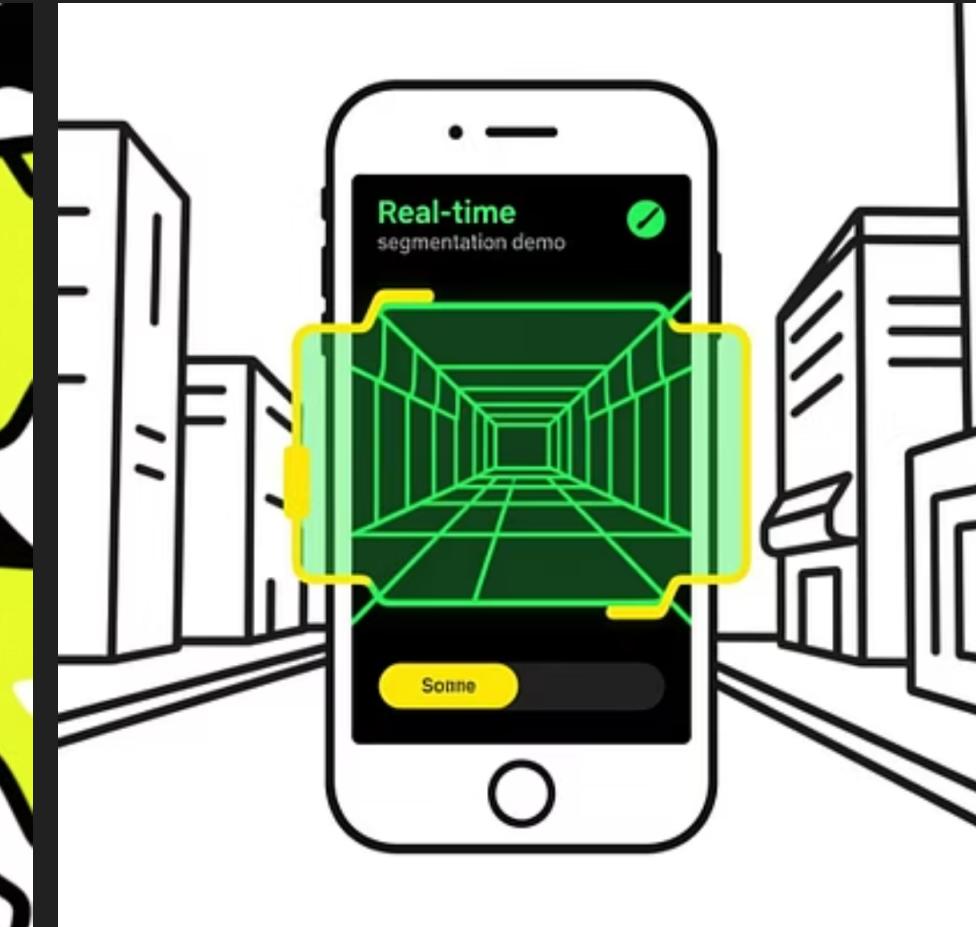
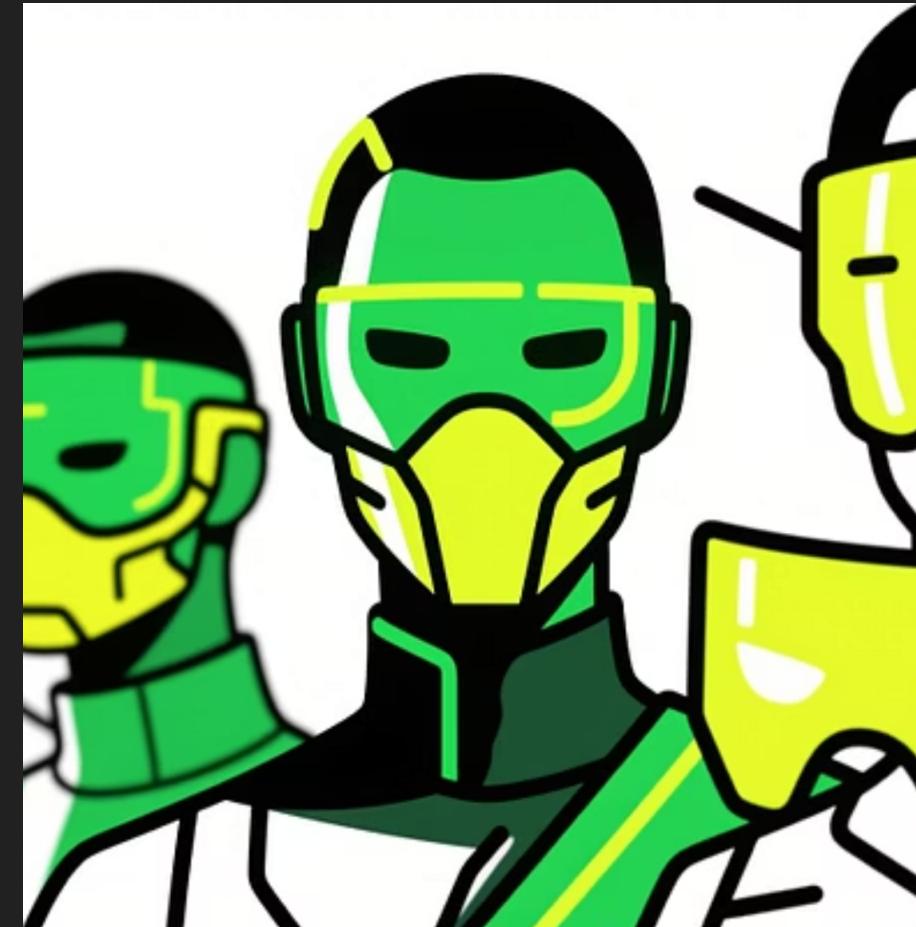
Traditional models offer far higher FPS and lower latency—better for real-time use and constrained compute.



Deployment Choices

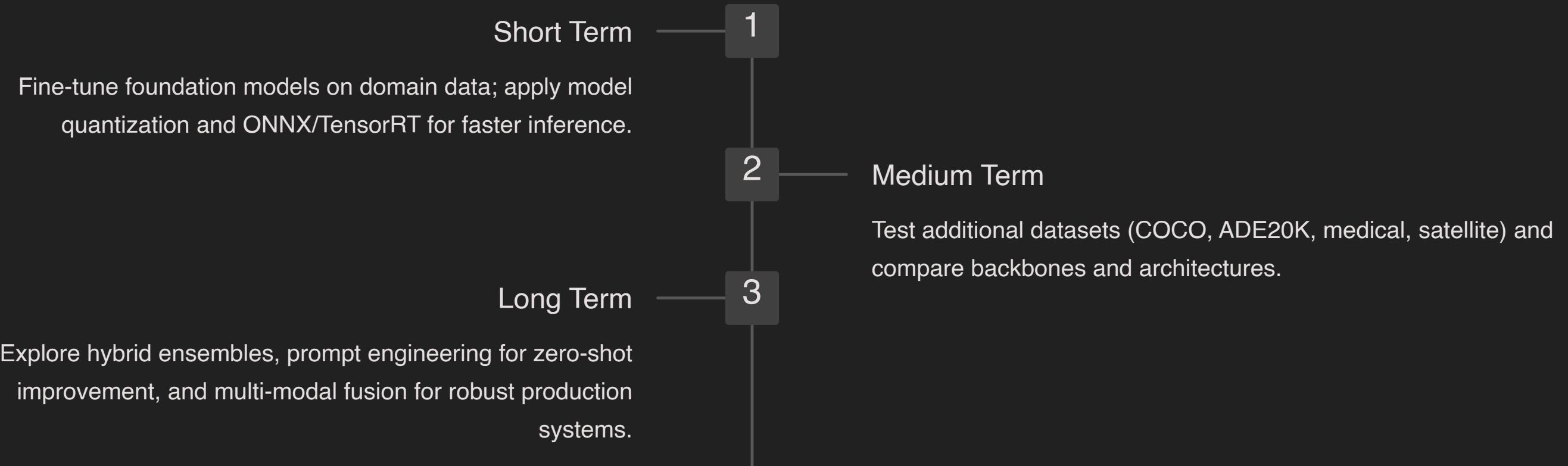
Use traditional models when labelled data and real-time needs exist; use foundation models for rapid, flexible deployment when labels are scarce.

Recommendation: consider hybrid strategies—fine-tune foundation models or ensemble approaches to capture both adaptability and peak accuracy.



Conclusions & Future Directions

Traditional models demonstrate superior accuracy and efficiency for domain-specific segmentation when sufficient labelled data is available. Foundation models provide powerful zero-shot generalisation and rapid deployment but may underperform on specialised datasets. The right choice depends on data availability, domain specificity and deployment constraints.



- ❑ References: Segment Anything (SAM), U-Net, DeepLabV3, PASCAL VOC, COCO. Key takeaways: combine approaches where appropriate to balance accuracy, speed and generalisation.