Team Details

Team Name:

SE<

SEM-i-CON

PHASE 1

YEAR

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Problem Statement Addressed

SEM images are critical for detecting fabrication defects in semiconductor manufacturing

Traditional manual inspection method is:
Time-consuming
Error-prone
Not scalable for high-volume fabs

Cloud-based AI models are:
Too large
Latency-heavy
Online Intensive

SEM-i-CON

Idea Description

Developed an edge-ready defect classification pipeline using:

- Lightweight CNN architecture
- Grayscale SEM images of Semiconductor Die Wafers
- ONNX deployment for hardware portability
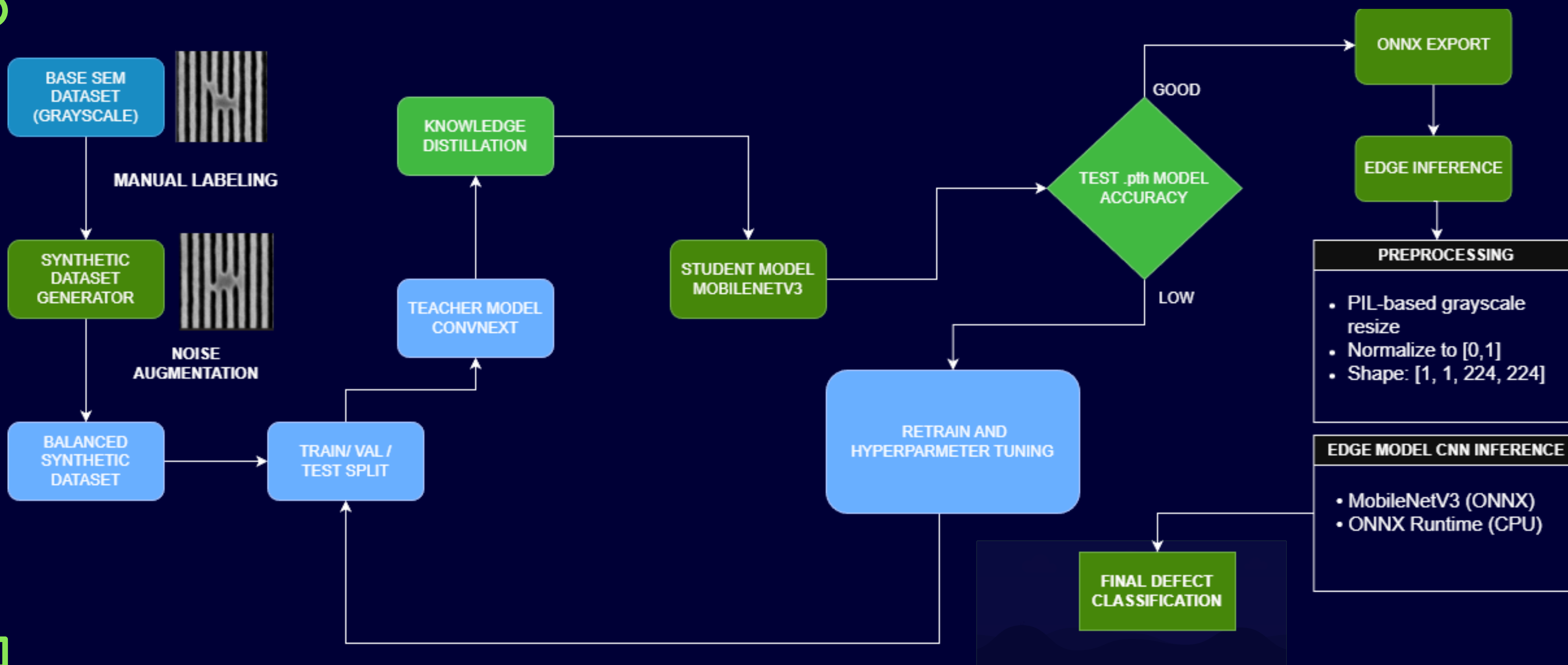
Innovation and Uniqueness

Self Learn model

Auto Edge Pipeline

Distilled MobilenetV3 trained from Convnext/tiny

Synthetic Dataset Prepared via GenAI and research Paper

ARCHITECTURE

Dataset Plan And Class Design

Dataset Details

- Total images (current): ~2400
- Image type: Grayscale

No. of Classes : 8

- Classes list : "bridge", "clean", "cmp", "crack", "ler", "open", "other", "via"

Class Balance Plan : 300 per class

Train / Val / Test Split : 70% / 15% / 15%

Labeling Source:

- Synthetic SEM generation + manual validation + research paper

Baseline Model and Result(phase1)

Baseline Model

1. Architecture: MobileNetV3 (CNN)
2. Training: Transfer learning + knowledge distillation
3. Input size: 224 × 224 (1-channel)
4. Framework: PyTorch
5. Model size: 6.045MB (.pth), ONNX deployed 5.8MB(.onnx.data)

Evaluation Results (Test Split)

1. Overall Accuracy: ~84.5%
2. Class-wise Accuracy (avg):
   a. Clean: 80.50%
   b. Defects: 80−91%
   c. Other: ~91.30%

Confusion matrix generated and validated on mixed noisy + clean SEM data.

Artifacts and Link

GitHub Repository:
- https://github.com/haddybhaiya/sem-i-con

Dataset ZIP:
- https://drive.google.com/drive/folders/16eWdfwJfuVV2kBwTZAlm7GFnwZbKSBzu?usp=sharing

ONNX Model:
- https://drive.google.com/drive/folders/1Sx_sw75ysi-IVEnsodQMJ64DUIs-huav?usp=sharing

References (2–3 only)
1. https://arxiv.org/html/2407.10348v1#S2
2. https://ar5iv.labs.arxiv.org/html/2211.02185
3. https://researchdata.ntu.edu.sg/dataset.xhtml?persistentId=doi:10.21979/N9/WBLTFI