PIXEL-LEVEL CRACK DETECTION IN LEVEE SYSTEMS:
A COMPARATIVE STUDY

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Outline

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Problem Statement
Current Approach

- **Manual** inspection of collected images
- Stacking-based Machine Learning Method
- Single Shot MultiBox Detector (SSD) for **Object Localization**

Motivation

• Limited number of levee crack images
• Object detection model could not detect specific crack areas
• Deep Learning based Image segmentation techniques focus only on crack areas
• Useful in identifying size of cracks, crucial for precise monitoring
Segmentation Techniques

Original Image + Ground Truth → Predicted Segmentation Mask

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Encoder-Decoder Architecture

Contracting Path: Encoder extracts meaningful features
Expanding path: Decoder generates segmentation mask
Experimental Setup

**Existing Methods**
- ResUNet
- Segnet
- R2U-Net
- U-net
- Attention U-Net
- UNet++
- MultiResUnet

**Evaluation**
- Mean Intersection Over Union (mIoU)
- 10-Fold Cross Validation (10-Fold CV)

**Dataset**
- Augmented Benchmark Levee Crack Dataset [1650 images, 256 × 256 × 3]
- Independent Test Dataset [6 images]
Results
Examples of independent test data
• (a) original image
• (b) ground truth overlay on the original image
• (c) U-net prediction
• (d) MultiResUnet prediction
• (e) Attention U-net prediction
• (f) UNet++ prediction
Conclusion

• U-net, Attention U-net, UNet++ and MultiResUnet performed competitively 10-Fold CV evaluation

• Segmentation methods well suited for automated identification of cracks in levee systems
Thank You!