

# TUNSPEKT

## Innovative Road Tunnel Inspection with AI

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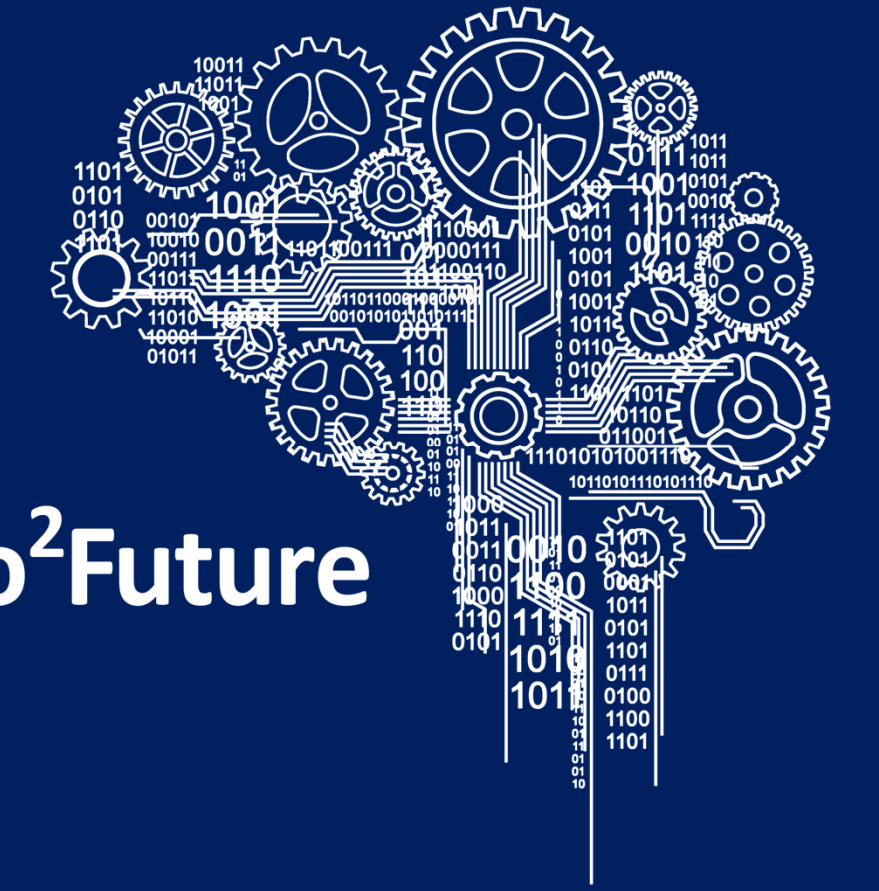
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## MOTIVATION & GOALS

TUNSPEKT aims to enhance road tunnel inspect, focusing on particular problems

- areas difficult to access (off main tunnel)
- AI for the Automation of Damage-Inspection and Analysis
- BIM considerations.

thereby supporting the long-term goal of cost-efficient road tunnel maintenance.

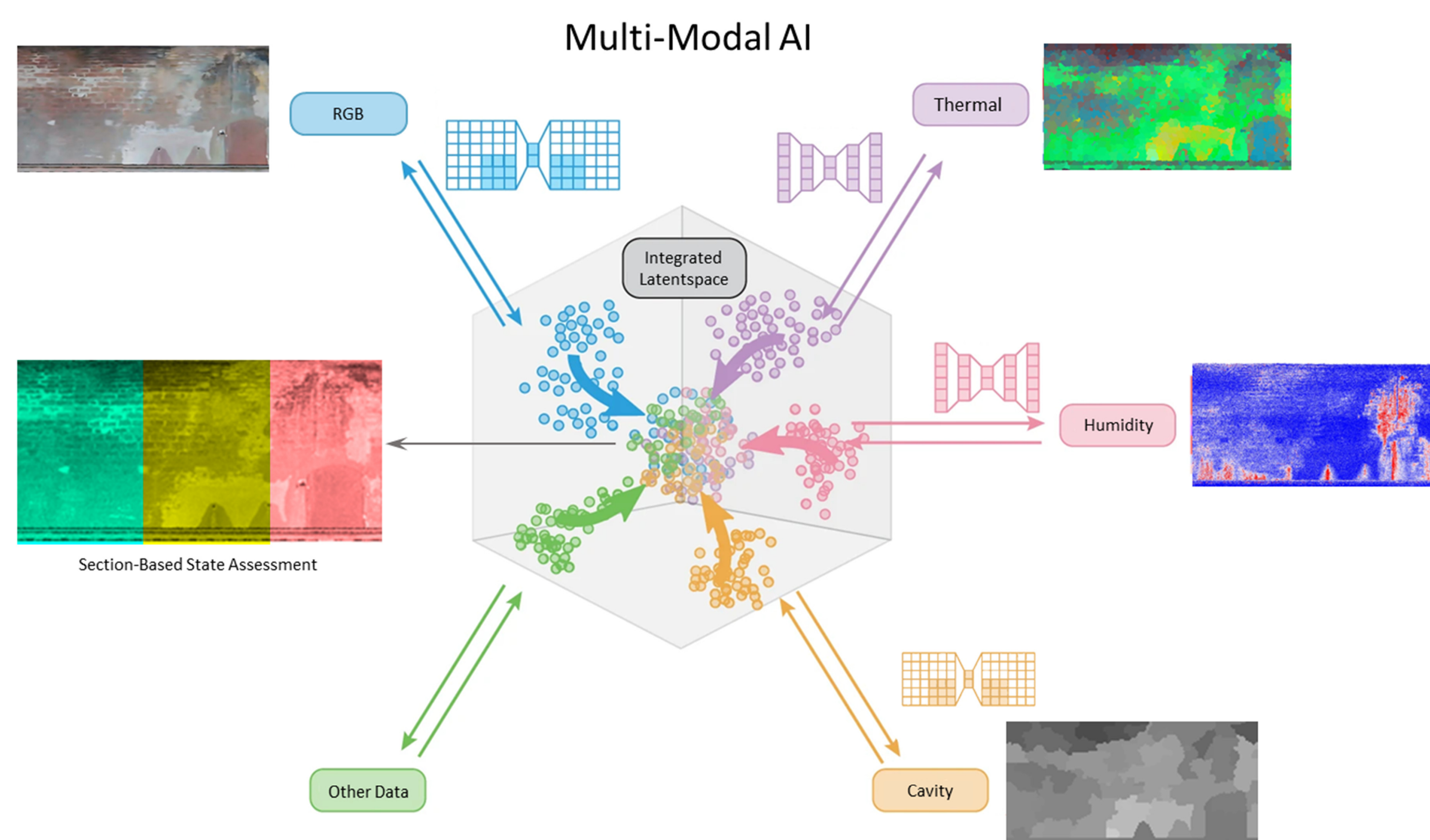
### Project FactBox

**Project Name** TUNSPEKT  
**Project ID** FFG 919059  
**Duration** 30 Months

**Area 1**  
Area Perception

**Project Lead**  
Dr. Michael Mett  
Dr. Michael Haslgrübler

## MULTI-MODAL APPROACH



Adapted from [3]

## CONTRIBUTION

### Scientific contribution

Combine SOTA concept into specific problem domains, with specific problems:

- Large quantity of unlabelled data
- Little Availability of Multi-Modal dataset
- Spatial Alignment Issues
- Novel Sensor Data Fusion
- Mixed Label

### Economic contribution

Viability of AI for the Automation of Tunnel Inspection, focusing on

- Single Modality AI (e.g. crack detection)
- Multi-Modal AI (e.g., RGB + Thermal)
- Multi-Temporal and Multi-Modal AIs (RGB + Thermal over Time)

## INITITAL RESULTS – SINGLE MODALITY AI

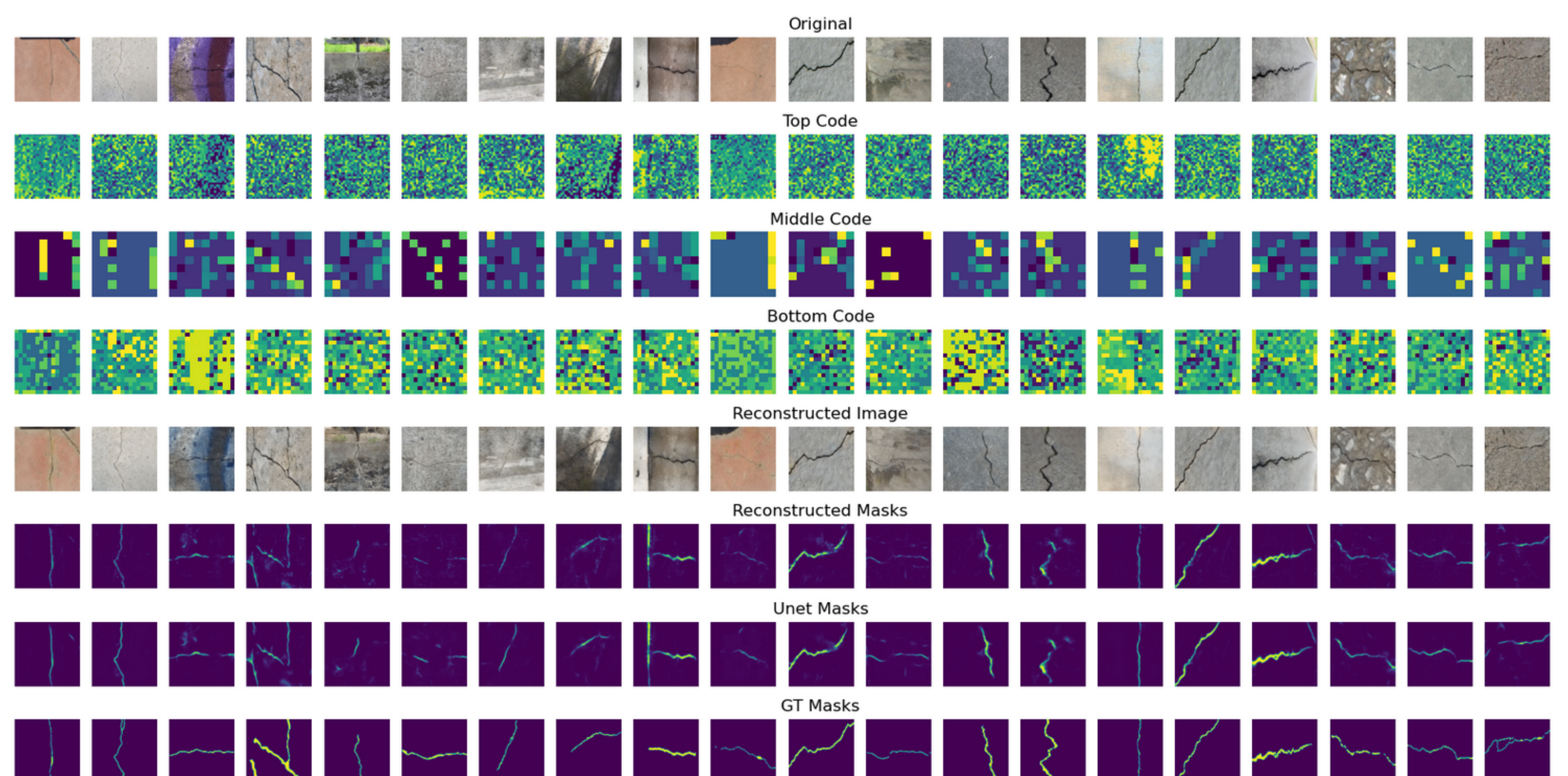
### Datasets:

- SDNET2018 Dataset; 56,000 Images just crack or no crack labels.
- Bochum Crack Dataset; 370 Images Pixel Wise Annotation
- Deepcrack Dataset; 537 Images Pixel Wise Annotations

### Computer Vision Models:

- Unsupervised Reconstruction, based on HQ-VAE [1]
- Mask Refinement Model, based on U-Net [2]

[1] Takida, Y., Ikemiya, Y., Shibuya, T., Shimada, K., Choi, W., Lai, C. H., ... & Mitsufuji, Y. (2024). HQ-VAE: Hierarchical Discrete Representation Learning with Variational Bayes. Trans. Mach. Learn. Res.  
[2] O. Ronneberger, P. Fischer, and T. Brox, "U-Net: Convolutional networks for biomedical image segmentation," in Proc. Int. Conf. Med. Image Comput. Comput.-Assist. Intervention, Springer, 2015, pp. 234–241.  
[3] Yang, K. D., Belyaeva, A., Venkatachalapathy, S., Damodaran, K., Katcoff, A., Radhakrishnan, A., ... & Uhler, C. (2021). Multi-domain translation between single-cell imaging and sequencing data using autoencoders. Nature communications, 12(1), 31.



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