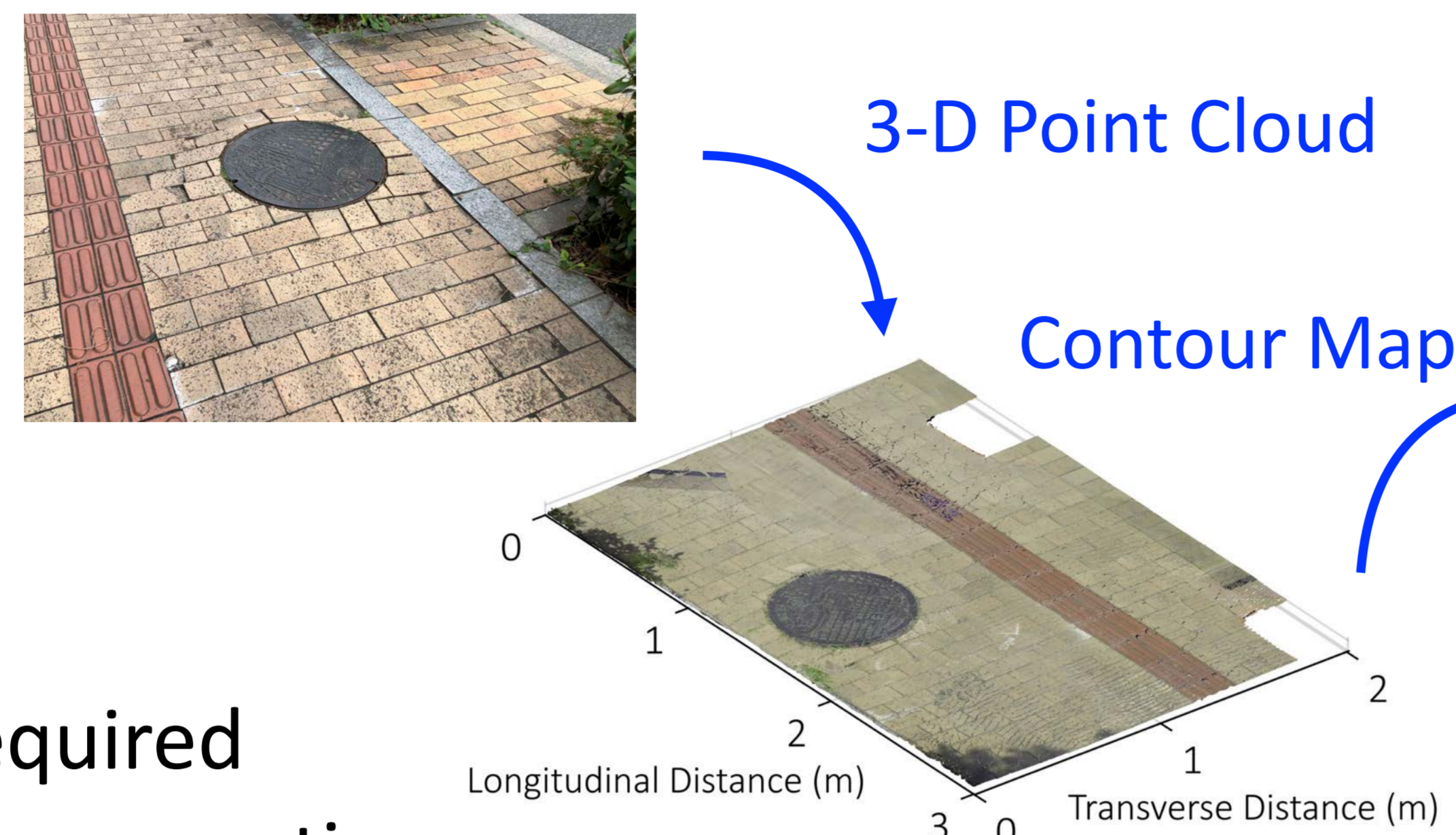


Background

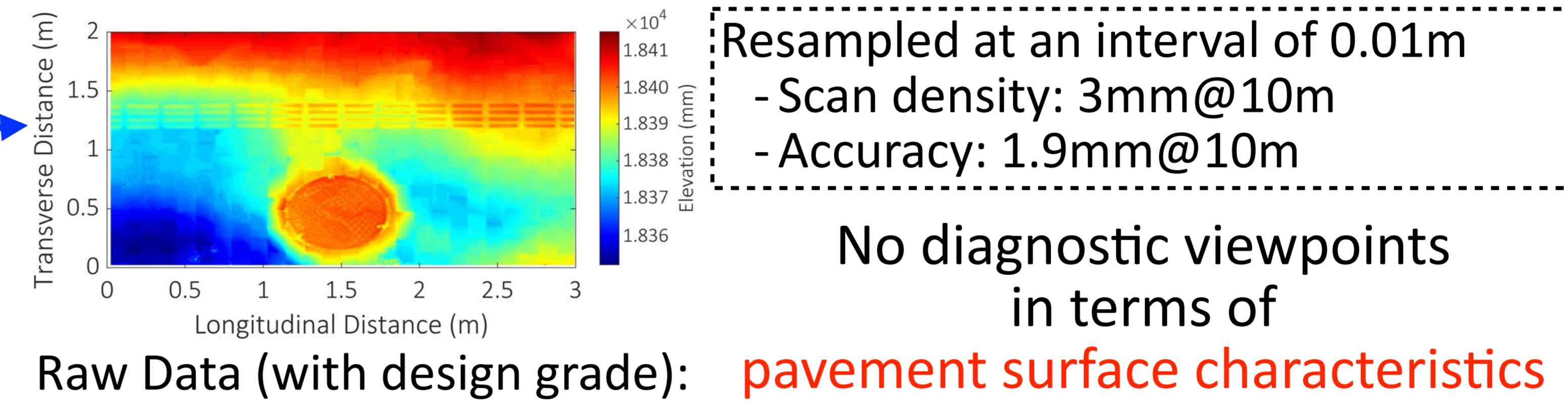
Applications of 3-D measurement

- have great advantages in
 - ✓ use of much information
 - ✓ detection of localized irregularities
- still face challenges for
 - ✗ identification of the information required
 - ✗ interpretation of functional surface properties



Case Study for Validation

Visualization of surface elevation



Measurement System

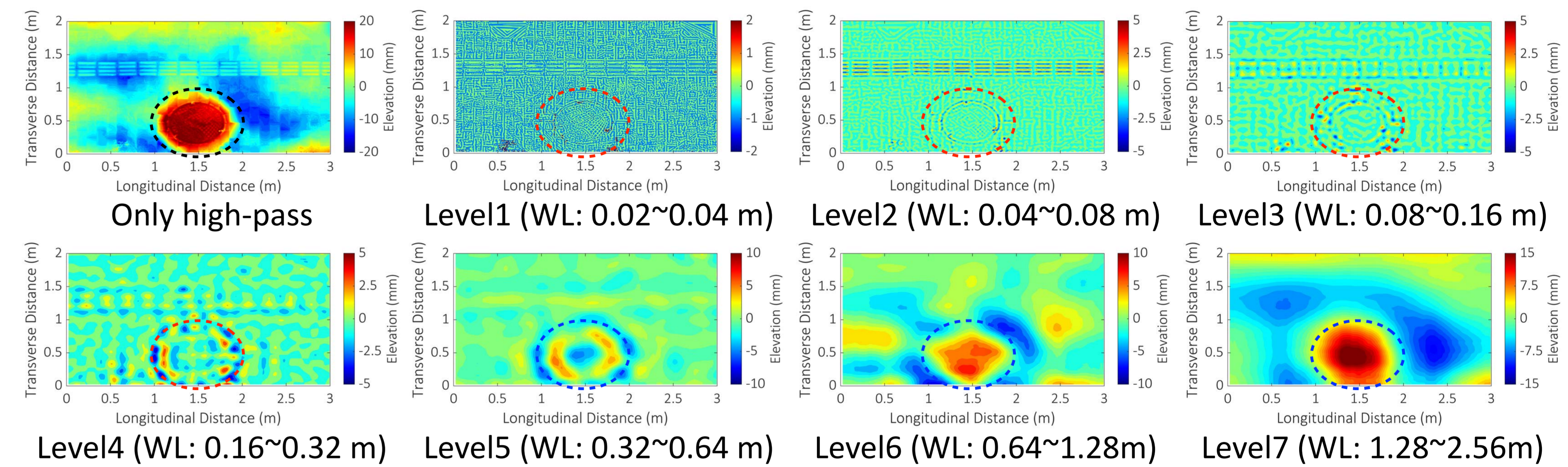


Mobile 4-wheel scooter with TLS (Terrestrial Laser Scanner) available on walkways.

Mathematical analysis of 3D point clouds with **Dual-tree Complex Wavelet Transform (DTCWT)**

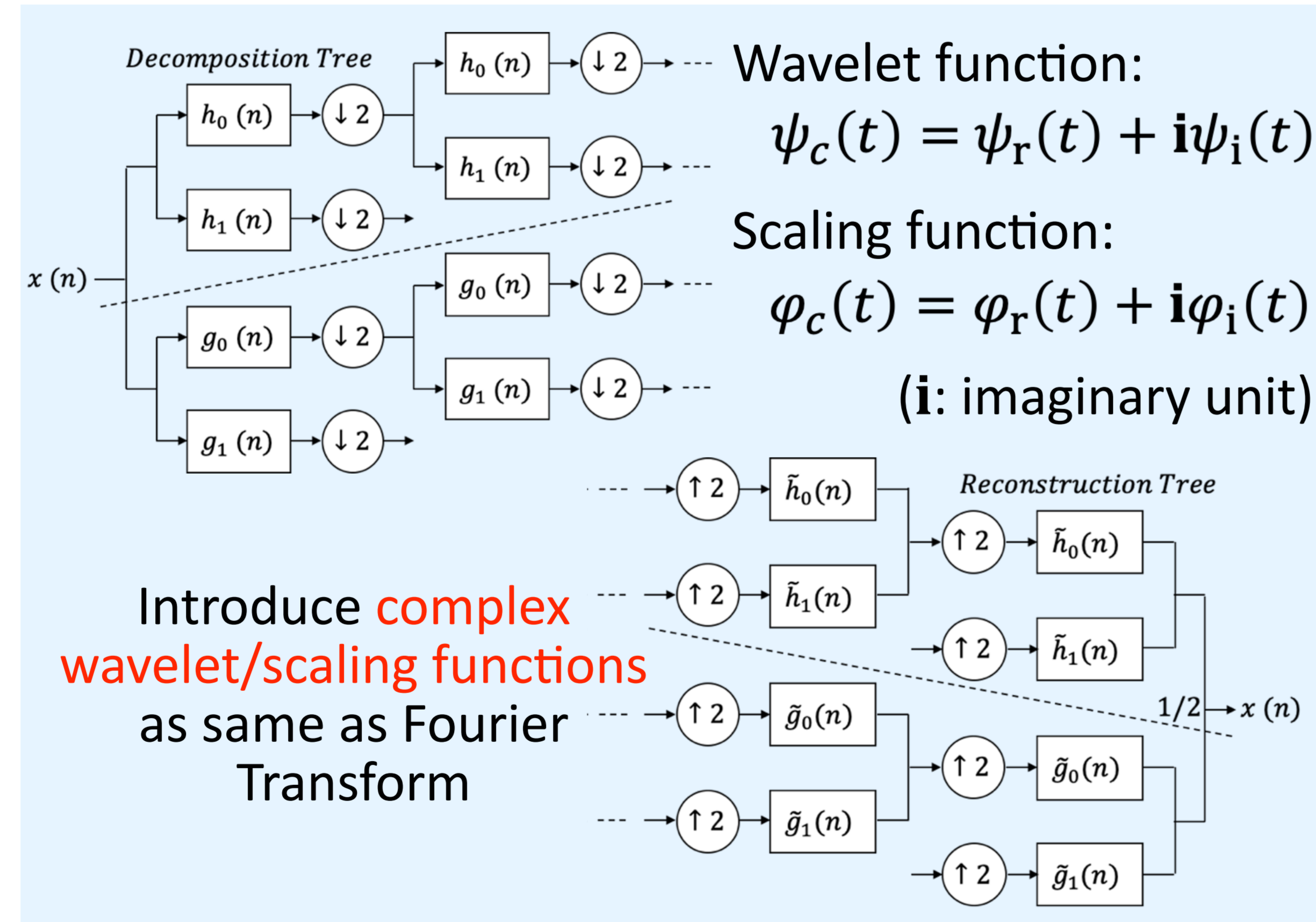
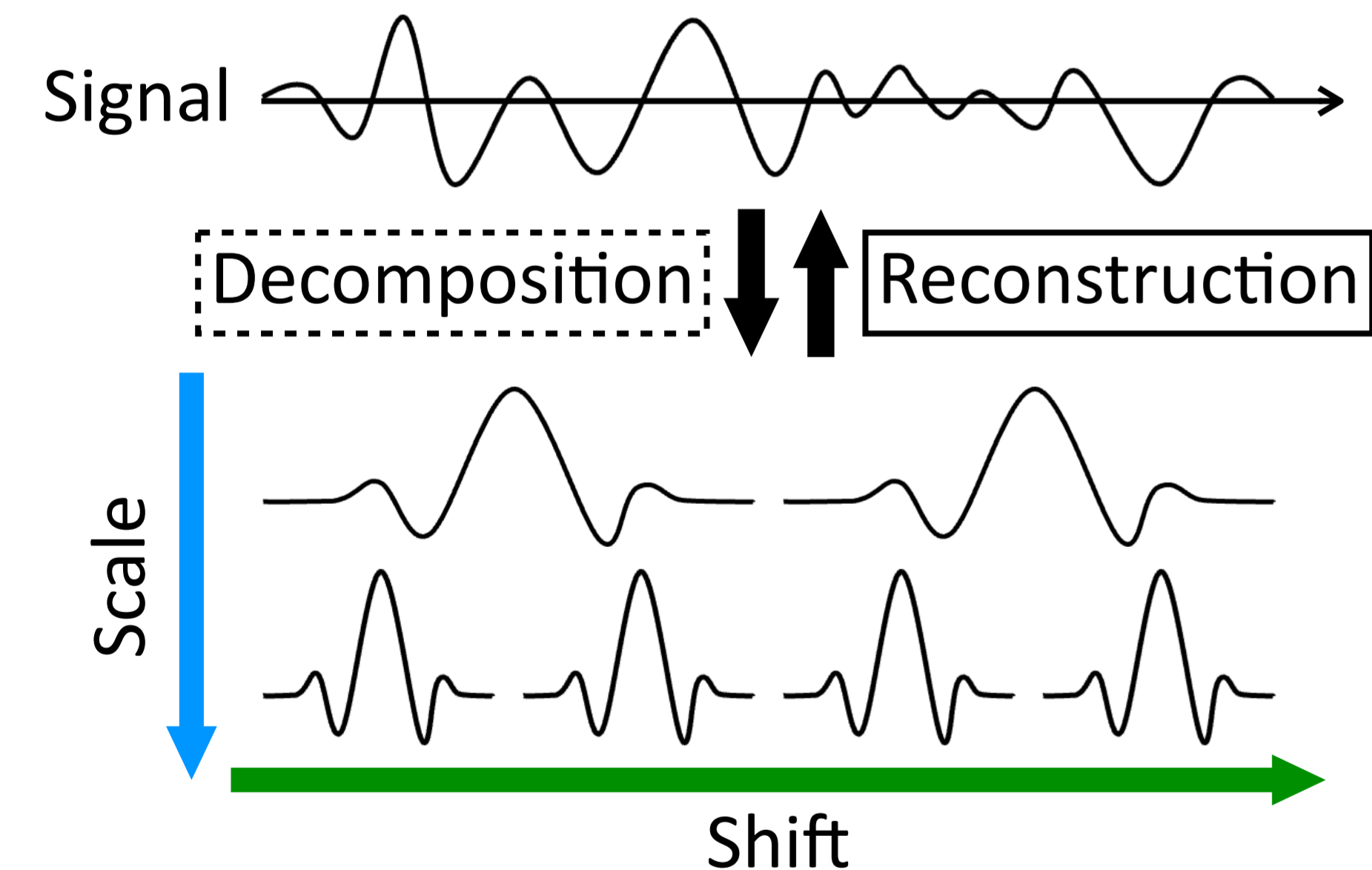
- ❖ **Effective and efficient** data processing **Practical**
- ❖ **Diagnostic** identification of illegalities **Functional**
- ❖ **Clear and theoretical** evidence for the analysis **Theoretical**

Directional Multiresolution Analysis

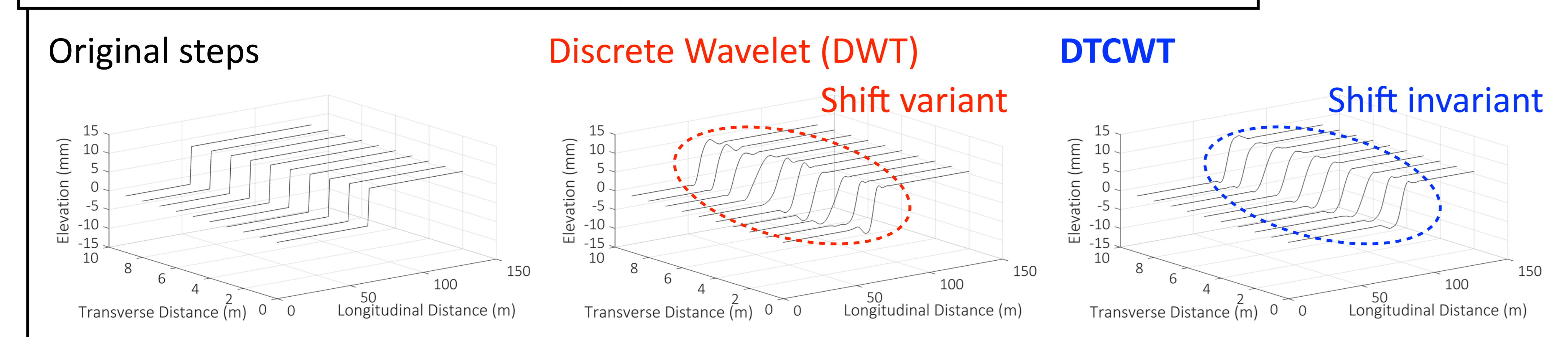


Theory of DTCWT

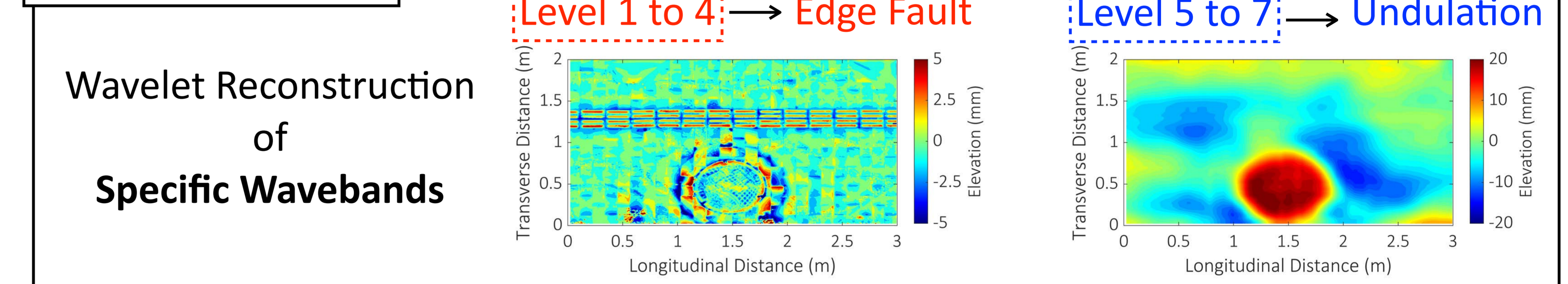
Effective and efficient decomposition and reconstruction



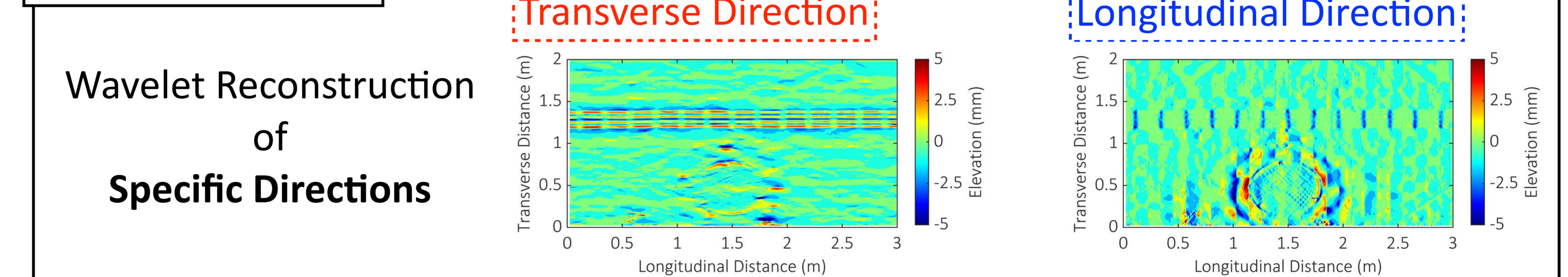
Approximately **shift invariant analysis** by a pair of decomposition trees



Functional Diagnosis



Directional Analysis



Summary

- Zone-based evaluation of road surfaces by DTCWT with 3D point clouds
- ✓ Efficient processing and effective analysis of 3D data
- ✓ Theoretical identification and visualization of surface irregularities