WORLD CONFERENCE ON STUDENT - CENTERED LEARNING APPROACHES

COMPUTER VISION AND ARTIFICIAL INTELLIGENCE FOR ASSESSING SOIL SETTLEMENT IN GEOTECHNICS

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Research note: This manuscript proposes a methodology. No experimental dataset or measured results were supplied; therefore, no numerical findings are claimed.

Abstract

Soil settlement under loading is an important geotechnical problem that can affect the performance of foundations and structures. This thesis proposes a method that combines computer vision and machine learning to assess soil-surface displacement in laboratory tests. Sequential images are captured during staged loading, reference points are tracked, and calibrated image coordinates are converted into physical displacement. A regression model may then relate settlement estimates to applied pressure, moisture content, void ratio, specimen thickness and elapsed time. Model performance can be evaluated using independent displacement measurements and the root mean square error metric. This contribution is a proposed methodology rather than a report of completed experiments; no measured results are presented.

Keywords: computer vision; geotechnics; ground settlement; machine learning; soil deformation.

1. Introduction

Reliable assessment of soil settlement is essential in geotechnical engineering. Conventional laboratory and field methods provide important measurements, while computer vision offers a possible non-contact approach for tracking visible surface movement. When combined with machine learning, image-derived measurements may help investigate relationships between loading conditions, soil properties and

settlement [1, 2].

2. Aim and method

The aim is to outline a reproducible workflow for estimating soil settlement from digital images. A soil specimen is subjected to controlled loading while images are acquired at defined intervals. Reference markers are tracked between images and image displacement is converted into physical units using camera calibration. Recorded variables may include applied pressure, moisture content, void ratio, specimen thickness and elapsed time. A regression model can be trained to estimate settlement and compared with independent measurements.

3. Evaluation and expected contribution

The proposed method can be evaluated using root mean square error between measured and predicted settlement. The evaluation should use data not included in model training and should account for correlations among observations from the same specimen. The expected contribution is a framework for automated image-based observation and model comparison. Its practical accuracy remains to be established experimentally; no experimental measurements or numerical performance claims are made in this thesis.

4. Conclusion

Computer vision and artificial intelligence provide a promising direction for supplementing geotechnical settlement monitoring. Reliable use requires calibrated imaging, stable acquisition conditions and validation against conventional measurements. Future work should implement the proposed laboratory procedure and test the approach across different soil types and loading conditions.

References

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