

We are looking for

Interdisciplinary project / Student assistant / Master thesis

to assist with the project

3D Knot Detection on Wooden Boards using Deep Learning

Project description:

Wood is becoming more and more popular in modern construction, due to its preferable mechanical properties, lowest energy consumption and CO₂ emission compared to other building material (concrete and steel). The existence of knots in wooden boards causes fiber-deviations and consequently significantly influences the strength of the boards. This project aims to build an automated system for knot detection (Fig. 1), subsequent knot-matching, and final 3D reconstruction of wooden boards (Fig. 2). This will enable researchers to design more accurate strength estimation methods such that wood will be used more efficiently, and consequently enlarging wood production and application.



Fig.1 Knot detection [1]

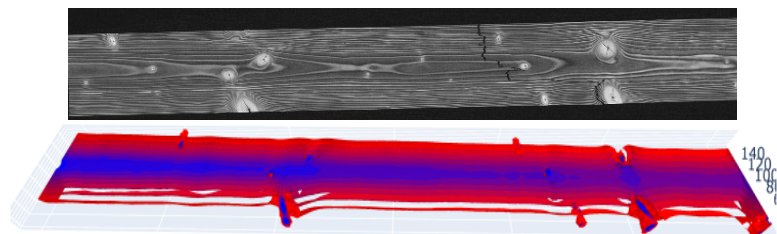


Fig.2 Reconstructed board compared with CT scan

Tasks:

1. Knot Detection with Deep Learning:
 - 1) Generate a synthetic training dataset of 3D wooden boards (Python implementation of the algorithm will be provided);
 - 2) Finetune a pretrained object detection (e.g. YOLO) or instance segmentation (e.g. Mask R-CNN) model on the synthetic training data to detect knots;
 - 3) Evaluate the model on synthetic data and on our existing database of 1000+ real images of wooden boards from Holzforshung München (HFM).
2. Based on the detected knots from Task 1, implement an algorithm to match knots detected on different sides of a wooden board. We will provide several papers/algorithms to you as an inspiration, but the choice of method and implementation will be up to you.
3. Based on the detected and matched knots, compute the 3D location of each knot.

Required Skills: Python, Deep Learning, Object Detection, Transfer Learning, Domain Adaptation

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