Chair of Computational Modeling and Simulation
TUM Deparment of Civil, Geo and Environmental Engineering
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AI-supported recognition of natural imperfections for reconstruction of timber

Wood is a natural fiber-based composite material with orthotropic material properties. Natural imperfections such as knots in timber boards have a significant impact on the distribution of fibers and need to be recognized and cathergorized. These locations can then describe the weak points in timber boards, which may cause failure initiation and propagation under mechanical loadings. By means of machine learning approaches and surface image analysis, these locations can be detected and classified [1-2]. However, knowing/estimating the geometrical origin of these imperfections [2] may help to classify the shape and geometrical configuration of these components.

Project Characteristics

Modeling:
Mathematics:
Programming:
Science:
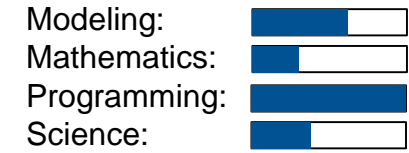
Task

- Apply deep learning based object detection or semantic segmentation method (e.g. Yolo, U-Net) for au-tomatic knot detection; extract the knot information (size, shape, etc.)
- Reconstruct the knot in 3D based on the information of recognized knot and its origin.
- Validate and improve the method's performance taking into account the material scatter and develop a FEM model for simulations

Knot detection, reconstruction [1];
Modeling timber boards with imperfections

[1] Lopes Jr, D. Verly, et al. "A fast and robust artificial intelligence technique for wood knot detection." BioResources 15.4 (2020): 9351.
[2] Briggert, Andreas, et al.. "Three-dimensional modelling of knots and pith loca-tion in Norway spruce boards using tracheid-effect scanning." European Journal of Wood and Wood Products 74.5 (2016): 725-739.

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