

Some Machine Learning Applications about Tree and Wood

Short Talk for Digital Forestry Retreat

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Paradigm

- *Objective*
- *Data*
- *Method*
- *Performance*

Lumber Identification

- **Objective:** Identify species of wood lumber based on **longitudinal section**.
- **Data:** 11 species, **3158 # board**, private dataset.
- **Method:** Image classification, several different CNNs.
- **Performance:** 98.2% Acc. (local test), unknown for real world production.

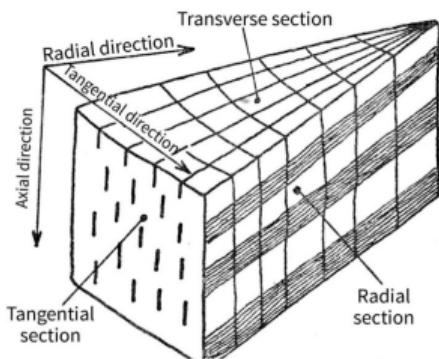


Figure 1. Left: three wood sections*. Right: sample images for lumber ID.

* <https://marette.smk.dk/-9711.html>

Wu, F., Gazo, R. et al. Wood identification based on longitudinal section images by using deep learning. *Wood Sci Technol* (2021).

Microscopic Wood Identification

- **Objective:** Identify species of microscopic wood slices.
- **Data:** 7426 species, **1-3 per species**, **> 100 attributes**, public dataset.
- **Method:** Image classification, **zero shot learning**.
- **Performance:** About 80% Acc. for attribute. (Acc. is not a good metrics).

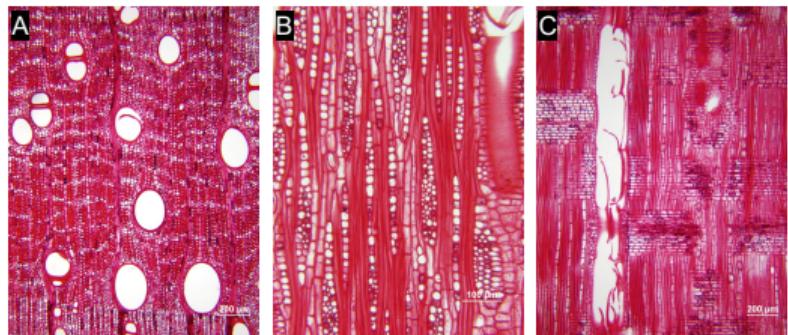


Figure 2. Left: a diagram of zero-shot learning*. Right: three wood sections of true hickory.

* Pourpanah, F. et al. A review of generalized zero-shot learning methods. (2020)

Wu, F., Gazo, R. et al. Learn attributes of microscopic wood images based on convolutional neural network. (2021)

Growth Ring Detection

- **Objective:** Identify and count tree ring from rough images.
- **Data:** 11 species, 12 cookies per species, **rough and clean surface**.
- **Method:** Semantic Segmentation and/or image classification.
- **Performance:** Unknown.



Figure 3. Left: Rough sample. Right: Clean sample under annotation.

Tree Bark Identification

- **Objective:** Identify species of tree based on bark with a **portable model**.
- **Data:** 20 species, 998 trees (public dataset), 10 species, 61 trees (private dataset).
- **Method:** Image classification, **knowledge distillation**.
- **Performance:** 96.12% (local test), Need improvement for App.

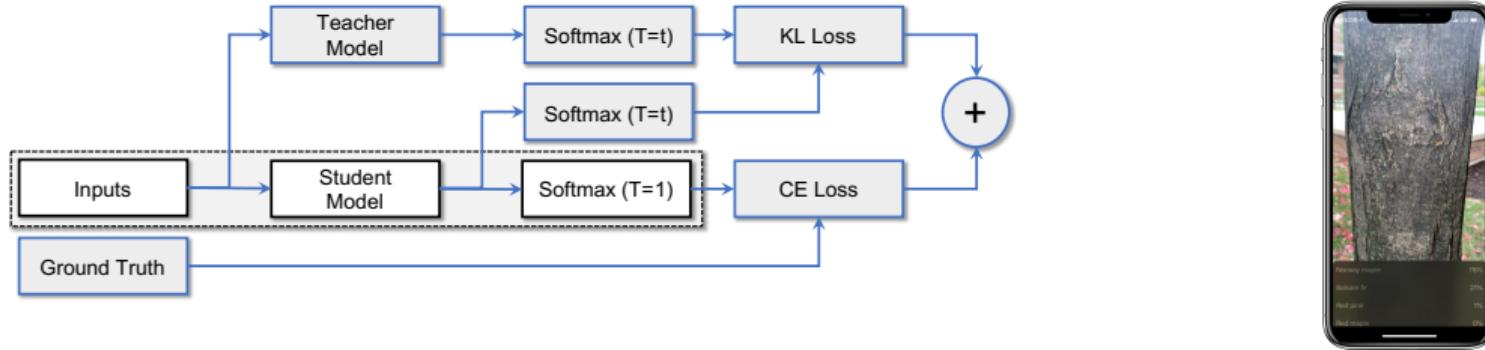


Figure 4. Left: visualization of our implementation of knowledge distillation. Right: bark ID App.

Question?

That's the end.

Reference



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Wood identification based on longitudinal section images by using deep learning.
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Farhad Pourpanah, Moloud Abdar, Yuxuan Luo, Xinlei Zhou, Ran Wang, Chee Peng Lim, and Xi-Zhao Wang.

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arXiv preprint arXiv:2011.08641, 2020.



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