

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.

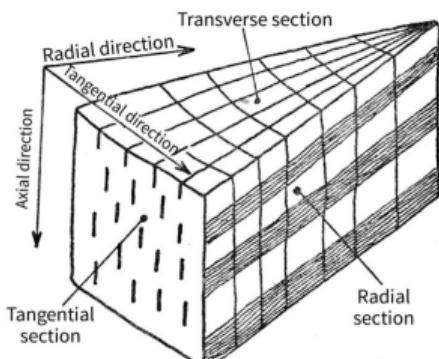


Figure 1. Left: three wood sections . Right: sample images for lumber ID.

<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).

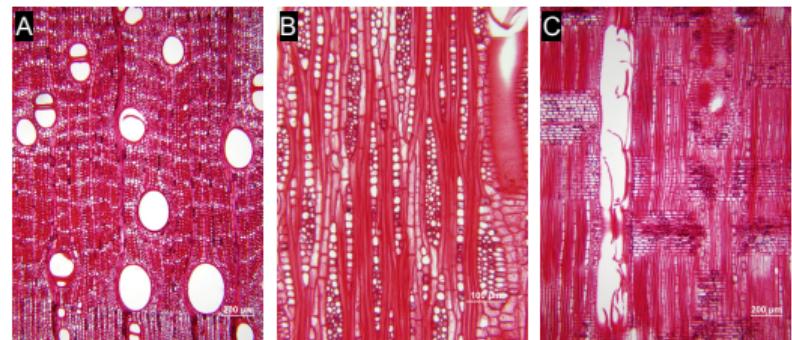


Figure 2. Left: a diagram of zero-shot learning. Right: tree wood sections of True Hickory.

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.

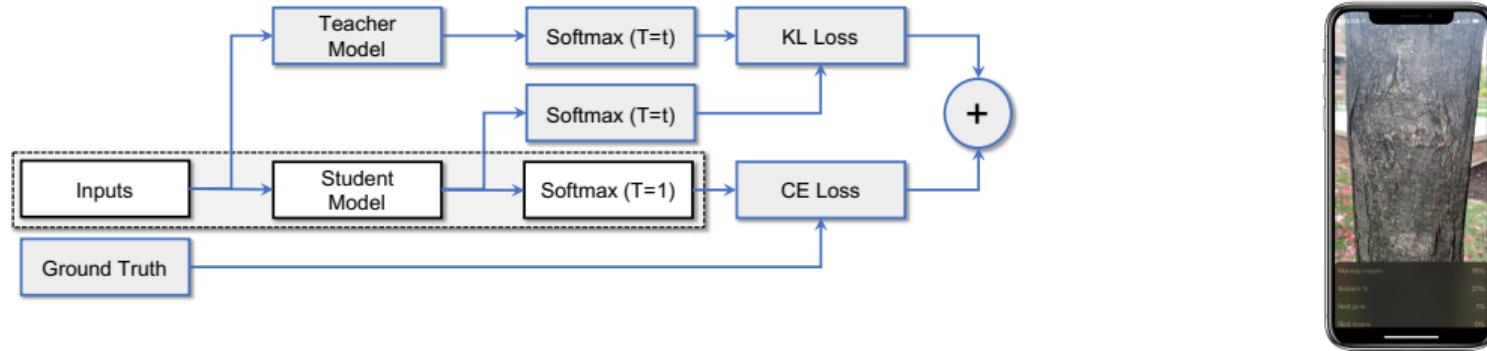


Figure 4. Left: visualization of our implementation of knowledge distillation. Right: bark ID App.

Question?

That's the end.

Reference



Fanyou Wu, Rado Gazo, Eva Haviarova, and Bedrich Benes.

Wood identification based on longitudinal section images by using deep learning.
Wood Science and Technology, 2021.



Fanyou Wu, Rado Gazo, Bedrich Benes, and Eva Haviarova.

Deep barkid: A portable tree bark identification system by knowledge distillation.
European Journal of Forest Research, 2021.



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