Computers help wood anatomists with wood identification

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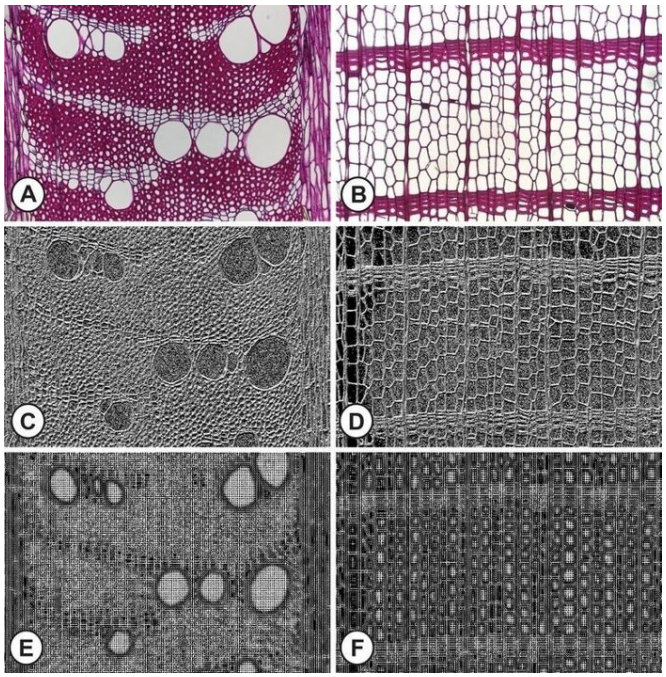

Fig. 1: (A) Original colored cross-sections of the wood of Grevillea robusta and (B) Taxodium distichum, with visualizations of some of the computer-extracted features (C-F) that help to identify the microscopic wood images down to species level. Credit: Leiden University

The most commonly used method for the taxonomic identification of tree trunks is wood anatomy. The number of experts in this area is decreasing, and education to become an wood anatomists takes many years. With the help of technology computer scientists of the Leiden Institute of Advanced Computer Science (LIACS) in collaboration with wood anatomists from Naturalis Biodiversity Center and internationally renowned specialists hope to develop a computer-aided tool for wood identification.

Illegal logging and wood identification

Forests cover 30% of the earth's land area, representing about four billion hectares and three trillion trees. Over the past fifteen years, forested regions comparable to the combined area of France, Spain and the United Kingdom have been lost worldwide. This loss both reduces the carbon storage of forests—one of our main buffers of CO_2 extracted from the atmosphere—and leads to declines in biodiversity. Recent evaluations of global logging show that deforestation in the tropics is currently occurring at an even faster pace, due to unsustainable agriculture, mining and illegal felling. However, illegal logging rarely leads to prosecution, as few efficient forensic tools are available for timber identification.

Wood anatomy remains the most commonly used method for the taxonomic identification of tree trunks. It takes years of training to become an expert in this field, however, leading to fewer wood anatomists with extensive experience. In addition, wood anatomists can generally identify wood at the level of the genus rather than the species, while the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) often requires species-level identification. For this reason, wood anatomists and computer scientists are now joining forces to develop faster and more accurate methods of identifying wood samples through computer-aided support for microscopic wood photographs.

Classification at the species level

Based on an existing database of microscopic cross-sectional images (fig. 1A-B), with 20 microscopic images for each of the 112 wood species examined, the researchers classified the images at the species level on the basis of computer-generated features (fig. 1C-F) that were compared to more advanced methods based on Deep Learning Computer technology helps to make timber identification easier or Convolutional Neural Networks (CNNs). Thanks to the Deep Learning approach, the recognition percentage of the

species has increased to as much as 96.4%. This offers opportunities to expand the available photo dataset with new cross-sectional and longitudinal images of all tree species on the CITES list, as well as the species that demonstrate strong wood-anatomical similarities with the CITES species. Thanks to this new reference database, it will be possible in the future to develop a tool that enables customs officials and other stakeholders to identify a block of wood even more accurately than experienced wood anatomy experts.

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