RECENT RESEARCH ACTIVITIES

Non-destructive technique for wood identification

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Our resent interests are to establish non-destructive testing methods to evaluate a variety of information from a given wood specimen, such as species, tree-rings, anatomical features, chemical composition, and physical properties. Among them, novel wood identification techniques developed recently, by making full use of wood database maintained at Xylarium, will be outlined briefly.

Near Infrared spectroscopy and multivariate analyisis

Near-infrared (NIR) spectroscopy, which is known as a rapid, accurate and reproducible technique, is an attractive choice. NIR spectroscopy is also suitable for assessing wood materials because the bands attributable to the vibrations of the chemical bonds involved in the formation of the cell wall allow for the direct and indirect estimation of the chemical and physical properties of the materials. When combined with multivariate analysis, NIR spectroscopy has potential to distinguish even species.

Pinus densiflora and *P. thunbergii* are varieties of pine trees that are very popular in Japan. The former is known as akamatsu, and the latter as kuromatsu. Both habitats are disributed widely in Japan. *P. densiflora* is commonly seen growing on the low mountains and hill- sides, while *P. thunbergii* is native to the coastal areas. Anatomically, these two species are nearly identical except for the degree of dentate thickening of the ray tracheids. When analysing present heartwood samples, NIR gave nearly perfect ability of correct identification [1]. Similar study is extended to investigate Korean pine wood used in traditional buildings, which showed that *P. densiflora*, and *P. sylvestris* were distinguishable [2,3].

However, when aging wood samples were used, the proposed discriminant function was found to be ineffective. Therefore, identification of aged wood samples from historical buildings by NIR is still questionable and requires more analysis to separate species-specific information from aging effect in the spectra [1].

Image recognition by texture analyisis

Kyushu National Museum was the fourth national museum in Japan, and it is devoted to the scientific investigation of artwork. Since the installation of a large-scale X-ray CT instrument, nearly 2000 wooden artifacts have been inspected. Unfortunately, the images were never considered as resources for analyzing wood properties. This is because the resolution of the image was too low to apply conventional wood identification that relies on the visual inspection of microscopic anatomical features. However, inspired by the recent advance in machine learning, the computer-aided recognition of low-resolution CT images recorded at Kyushu National Museum seemed to have a potential to be uncovered.

Recently, we constructed a original system for wood identification from low-resolution CT data using the GLCM and k-NN algorithm as a feature extractor and classifier, respectively. The system recognized 10 representative wood samples for sculpture almost perfectly, and the system is under continuous improvement [4].

References

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