Researchers turn to technology to discover a novel way of mapping landscapes

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University of Cincinnati researchers are blending technology with tradition, as they discover new and improved methods for mapping landscapes. The research is newly published in the *Journal of Applied Geography* (Vol. 45, December 2013) by UC authors Jacek Niesterowicz, a doctoral student in the geography department, and Professor Tomasz Stepinski, the Thomas Jefferson Chair of Space Exploration in the McMicken College of Arts and Sciences (A&S).

The researchers say the analysis is the first to use a technology from a field of machine vision to build a new map of landscape types – a generalization of a popular land cover/land use map. Whereas land cover/land use pertains to physical material at, or utilization of, the local piece of Earth's surface, a landscape type pertains to a pattern or a mosaic of different land covers over a larger neighborhood.

Machine vision is a subfield of computer science devoted to analyzing and understanding the content of images. A role of a machine vision algorithm is to "see" and interpret images as close to human vision interpretation as possible. Previous uses of the technology have focused on medicine, industry and government, ranging from robotics to face detection.

The UC research focused on a very large map of land cover/land use, called the National Land Cover Database 2006, developed by the U.S. Geological Survey.

Niesterowicz says he developed and applied machine vision-based algorithms to map landscape types in an area of northern Georgia that he selected because of the diverse patterns of land cover. The result allowed the researchers to discover and differentiate 15 distinctive landscape types, including separating forests by their domination of different plant species.

"Before now, people would do this mapping by hand, but if you had 10 maps drawn by 10 people, they would all be different," says Stepinski.

Niesterowicz says the information uncovered by auto-mapping of landscape types would be useful for a number of fields, ranging from geographic research to land management, urban planning and conservation.

"The good thing about this method is that it doesn't need to be restricted to land cover or other physical variables – it can be applied as well to socio-economic data, such as U.S. Census data, for example," says Niesterowicz.

"It's an entirely new way to conduct geographic research," says Stepinski.

"By leveraging technology developed in the field of computer science, it's possible to make geography searchable by content. Using this technique, for example, we can quickly discover (using Web-based applications on our website) that farms in Minnesota are on average larger than farms in Ohio, and ask why that is."

The researchers say future research will involve using the method to identify characteristic landscape types (from waterways to forests to regions influenced by human habitation) over the entire United States.

Stepinski adds that longer-term applications could involve comparisons of landscape types of other countries with those of the United States and to identify characteristic patterns of different geographical entities, such as terrain, or human patterns including socioeconomics and race.

Provided by University of Cincinnati