



Could centuries-old techniques used to classify species hold the key to computerized face recognition? Professor Peter Belhumeur certainly thinks so. Face recognition has many potential uses, from verifying financial transactions to recognizing terrorists and criminals. Today's systems work by superimposing a subject's face over images in a database. If they align, the computer samples pixels from each image to see if they match.

The process is not very reliable. "Recognition algorithms make mistakes that they should never make, like confusing men with women, or one ethnicity with another," Belhumeur said. Belhumeur was working on improving those algorithms when Smithsonian Institute taxonomists asked for help developing software to classify plant species from photos of their leaves.

Instead of superimposing images or matching pixels, Belhumeur drew on the wisdom of taxonomists dating back centuries. They classified plants by asking a series of questions whose yes-or-no answers narrowed the choices until they came to the right plant.

Belhumeur's software hopes to do this automatically. "We want to develop software that can determine whether a leaf is simple or compound, lobed or unlobed, and smooth or serrated along its edge, and then use these determinations to identify the species," he said. "This is exactly the opposite of how computerized object recognition is done. Instead of pixels, we want to compare visual attributes," he explained.

Belhumeur wondered if he could use a similar strategy to recognize faces. "Could we develop software that made qualitative decisions about each image? Is it a male or female? Young or old? Broad or pointy nose? Facial hair or not? If we could build reliable classifiers to answer these questions, we could search for pictures based on their attributes," he said.

Belhumeur's system uses roughly 100 labels, ranging from eye and nose shape to hair color and gender. In tests that compare a photo to a known image, like an identity card, it outperforms pixel-based technologies, he said.

It also makes it possible to search for pictures with words that describe visual attributes. "We could search through a database based on a victim's description of an assailant, or use it to search one's seemingly endless collection of digital photos," he concluded.

"Borrowing a concept from taxonomy, we could simplify object recognition by labeling objects in images with a list of highly descriptive visual attributions. A computer could then classify an image by recognizing these objects. We might also use text labels to browse or search for pictures."

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Turning a New Leaf on Face Recognition

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