

## **Image Understanding for Photos: How do humans and computers recognize image orientation?**

Automatic image orientation detection for photos is a useful, yet challenging research topic. Humans use scene context and semantic object recognition to identify the correct image orientation. However, it is difficult for a computer to perform the task in the same way because current object recognition algorithms are extremely limited in their scope and robustness.

A psychophysical study was conducted to understand human perception of image orientation. At each resolution, observers were asked to indicate the image orientation, the level of confidence, and the cues they used to make the decision. This study suggests that for typical images, the accuracy is close to 98% when using all available semantic cues from high-resolution images and 84% with only crude cues from thumbnails. The accuracy by humans provides an upper bound for the performance of an automatic system. In addition, the use of a large, representative image set ("photo space") and extensive interaction with the human observers reveal cues used by humans at various resolutions.

Computerized image orientation detection for photos is a largely untouched research area until recently. The existing methods were built upon low-level vision features such as spatial distributions of color, edge, and texture. We have developed a novel method for image orientation detection by integrating low-level and selected semantic features within a probabilistic framework. Our current accuracy is 90%, promising given the findings of the psychophysical study.

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