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Border ownership assignment in real images

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We explored whether spectral based cues, such as *extremal edges*, are useful for border ownership classification in real images, and we analyzed how different environments: indoor vs. outdoor affect the prediction. Our algorithmic approach is based on a random forest classifier using spectral and Gestalt-like texture grouping features. The classifier detects in real-time the points in the image, which are likely borders and assigns their border-ownership. Training was achieved using annotated images. The spectral cues were obtained by performing a principal component analysis (PCA) over clusters of edge patches, and then re-projecting the input image using the top four principal components (PCs). Global relations were implemented using a novel semi-global Gestalt detector of closure, spiral, radial and hyperbolic patterns. Inference over a 481x321 image takes about 0.1s using commodity hardware in Matlab. The method was evaluated on a dataset of outdoor images (BSDS-300) and a dataset of indoor images (NYU-Depth V2). Testing over different feature ablations showed that spectral features are better ownership predictors on indoor images while Gestalt features are more useful for outdoor images. The PCs obtained from both datasets further show that the extremal edge cue is more dominant in indoor scenes: it was found as the second PC in indoor images and as the third PC in outdoor images. Combining all features yields 74% and 68% classification accuracy on BSDS-300 and NYU-Depth V2, respectively. Our algorithmic approach confirms the feasibility of computing border ownership using spectral and other information in single images, and it also provides a useful computational tool that can serve as preprocessing step for other geometric scene interpretation processes, such as image segmentation and 3D scene interpretation.