Images as Fields of Junctions

Abstract:

Which pixels belong to a segment, and where are the boundaries between segments? My talk revisits these long-lasting questions about grouping, this time knowing that approximate segments and boundaries can often be provided by deep feedforward networks. In this context I focus on exactness and robustness, aiming to localize boundaries, including corners and junctions, with high spatial precision and with enhanced stability under noise. The approach is to represent the appearance of each small receptive field by a low-parameter, piecewise smooth model (a generalized junction), and to iteratively estimate these local parameters using parallel mean-field updates. I introduce initialization and refinement algorithms that allow this to succeed, despite the problem's non-convexity, and I show experimentally that the resulting approach extracts precise edges, curves, corners, junctions and boundary-aware smoothing—all at the same time. I also show that it exhibits unprecedented resilience to noise, providing stable output at high noise levels where previous methods fail. (Work done at Harvard University)