

Abstract Submitted
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A community detection approach to image segmentation and its phases DANDAN HU, PETER RONHOVDE, ZOHAR NUSSINOV, Department of Physics, Washington University in St. Louis — In this talk, I will discuss “unsupervised” image segmentation that relies on phase diagram structure of the community detection method. Specifically, we apply a replica-inference-based community detection method. “Community detection” describes the general problem of partitioning a complex system involving many elements into optimally decoupled communities of such elements. In our image segmentation analysis, we invoke a multi-resolution community detection variant to ascertain the overall structure of the image at different resolutions. Information based measures (e.g., the normalized mutual information) are used to determine the significant structures at which “replicas” of the systems are strongly correlated. We report on the “easy”, “hard”, and “unsolvable” phases of the corresponding Potts model at both zero and finite temperatures. The optimal image segmentations are obtained by choosing parameters at the easy phase of the Potts model. The determination of the phase diagram in the analysis of the image segmentation is proved to be highly efficient. We demonstrate in a detailed study of various test cases that our method is fast and accurate and to be especially suited to the detection of camouflaged images.

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