Determinantal point processes for image processing

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Determinantal point processes (DPPs) are probabilistic models of configurations that favor diversity or repulsion. In addition to a renewed interest in stochastic geometry and spatial statistics, they have recently gained influence in the machine learning community, mainly because of their ability to elegantly and efficiently subsample large sets of data. In this work, we consider DPPs from an image processing perspective, meaning that the data we want to subsample are pixels or patches of a given image. To this end, our framework is discrete and finite. First, we adapt their basic definition and properties to DPPs defined on the pixels of an image, that we call determinantal pixel processes (DPixPs). We are mainly interested in the repulsion properties of such a process and we apply DPixPs to texture synthesis using shot noise models. Finally, we study DPPs on the set of patches of an image. Because of their repulsive property, DPPs provide a strong tool to subsample discrete distributions such as that of image patches.

This is a joint work with former PhD student Claire Launay (now postdoctoral researcher at Albert Einstein College of Medicine, New York, United States) and Agnès Desolneux (Senior Researcher at CNRS and ENS Paris-Saclay).

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