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The measure and analysis of eye movements is crucial to neuroscience and psychology [10]. Eye movements are extremely useful from a methodological point of view - among other things, it is relatively easy to train animals to respond using eye movements, and the neurophysiological pathways involved are relatively well understood [6]. Eye movements are also tremendously interesting as an object of study in their own right, because they are the most immediate means we have to explore our visual environment.

In humans, the eyes do not move constantly but rather alternate between periods of relative stability, called fixations, and periods of movement. Very often the analysis is not concerned with movements but rather with fixations, and most especially where fixations occur. For example, in so-called "free-viewing" experiments, subjects view natural images, with no specific instructions - they are free to look wherever they like. Where they choose to fixate is far from random: subjects focus on similar locations, and exactly why they do that is an old debate in neuroscience and psychology [11, 8].

Some authors have argued that eye movements are controlled by a cortical *saliency map* [5], which represents interesting locations in the visual field, and that "interestingness" is computed very

early in the visual cortex using local image information. Following these ideas, models have been developed that seek to predict fixations from local image features [4]. Exactly what is being predicted and how is a source of some confusion in the literature, and many different methods have been proposed, with no unifying framework so far [12].
We argue that the right framework is to be found in the tools of spatial statistics [2]. A set of fixations is in essence spatial data - a set of points in space. For such data, appropriate statistical models are known as point processes: a point process is a probability distribution over finite subsets of a spatial domain. There is an extensive literature on how point process models can be used to analyse point patterns, reviewed for example in [3] and [7].
While the literature on point processes focuses mostly on studying the outcome of one point process, fixation data is better thought of as arising from many related point processes - for example, one process per image, or one process per subject, etc. The interesting questions often have to do with how fixation patterns vary (across subjects, across images) and whether they are common factors.
We have developed a R package called **mpp**, for "multiple point processes", which aims to facilitate Bayesian inference for such problems. It builds on the **spatstat** package [1] and uses **INLA** for approximate inference [9]. We will show how **mpp** can be used to explore some simple hierarchical point process models applied to fixation locations.

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