- Wednesday, December 14, 2005
  Bottom up saliency map by a single stage V1 process rather than a combination of feature maps

  Attentional selection of visual inputs integrates the top-down and the bottom-up mechanisms. Saliency, defined as the extent to which a stimulus attracts attention, provides a useful platform to study the attentional mechanisms. Highly salient visual locations, e.g., a red item among green ones, or a horizontal bar among vertical ones, attract attention through bottom-up or stimulus driven mechanisms. The standard view assumes that visual inputs are processed by separate feature maps such as red and green maps, each for a feature value in a few basic dimensions like color and orientation, which are then summed to a spatial master map of bottom-up saliencies. Any assumptions about this bottom-up saliency map can greatly influence assumptions about the top-down mechanisms, and should therefore be confirmed experimentally. We show, using psychophysical experiments (Zhaoping and May, SFN abstract 2004) on visual search and segmentation tasks, that summations or other simple combinations of the feature maps cannot explain the bottom-up saliency. Instead, a single stage computation by the primary visual cortex, using intra cortical interactions (Li TICS 2002), is adequate to explain the data, including the aspects of the data often associated with visual grouping. While V1 mechanisms suffice to account for our data, our framework does not exclude other cortical areas from contributing additionally to computing the bottom up saliency, and we will discuss when and how it could happen. We will discuss how our work relates to other works, and its implications on the top-down attentional mechanisms.

  Zhaoping Li
  Gatsby Neuroscience Unit, Imperial College London