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WHAT IS THE RIGHT METRIC FOR THE MODELLING OF FEATURE MAPS IN THE VISUAL CORTEX?

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Optical imaging experiments in the visual cortex of mammals show that the mean preferred stimulus features of each point of the cortical surface changes continously as a function over the position of the cortex surface. In many models the resulting feature 'maps' have been assumed to be a result of an optimization process of two competing optimization criteria, that are (1) the optimal folding of the map into the complete stimulus space and (2) a neighbourhood preservation. Neighboorhood preservation means that the developmental process results in neighboring neurons that prefer similar stimuli. Both criteria, optimal folding and neighbourhood preservation are dependent on assumptions of the underlying metrics of the stimulus space and its features. Research has been published earlier [1,2,3,4] that shows that the structure of the patterns that appear on those maps highly depend on other metrics in feature space. Most simple models assume an independent development of different feature spaces; for each feature they assume a Euklidean distance measure. More advanced are high-dimensional models that effectively use an assumed coupling between features and result in a feature metric that is effectively Riemannian. Still the 'real' metrics that underlies the cortical adaptation process remains unclear. The poster demonstrates earlier work on map development of cortical feature maps with focus on the work on non-Euklidean feature models. As a farther step, maps that combine tactile and visual features (cross modal maps) are presented [5]. The possible application of Fisher information as a metric to be used to evaluate the metric distance between neurons on the grid mesh of the model is discussed.

References

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