

Spherical Exponential Models

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In this talk we examine directional distributions as well as estimation and inference. The von-Mises Fisher distribution is a first order exponential model, the Bingham distribution is a second order exponential model and the Fisher-Bingham distribution combines the two. A restricted curved version is called the Kent distribution. In general we can incorporate higher order terms through spherical harmonics. This is then a canonical exponential model of arbitrary order on the hypersphere, therefore maximum likelihood estimation can be performed. However, the complications associated with having to approximate the complicated normalizing constant leads to a regression approach which avoids this complication but is asymptotically equivalent to the maximum likelihood estimator. In light of recent advancements in explicitly representing spherical harmonics on hyperspheres, this regression approach can now be easily implemented. Furthermore, with the formulated regression estimator statistical inference can be performed to obtain more information on the parameters. In addition we will modernize the regression based estimator using LASSO (least absolute shrinkage and selection operator) shrinkage as this would be very useful for variable selection in high dimensions. Some applications will be discussed.