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PCA meets RG SERENA BRADDE, CUNY/UPENN, WILLIAM BIALEK, Princeton University/CUNY — A system with many degrees of freedom can be characterized by a covariance matrix; principal components analysis (PCA) focuses on the eigenvalues of this matrix, hoping to find a lower dimensional description. But when the spectrum is nearly continuous, any distinction between components that we keep and those that we ignore becomes arbitrary; it then is natural to ask what happens as we vary this arbitrary cutoff. We argue that this problem is analogous to the momentum shell renormalization group (RG). Following this analogy, we can define relevant and irrelevant operators, where the role of dimensionality is played by properties of the eigenvalue density. These results also suggest an approach to the analysis of real data. As an example, we study neural activity in the vertebrate retina as it responds to naturalistic movies, and find evidence of behavior controlled by a nontrivial fixed point. Applied to financial data, our analysis separates modes dominated by sampling noise from a smaller but still macroscopic number of modes described by a non–Gaussian distribution.

Seren Bradde
UPenn

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