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Inference on covariance matrices and operators using concentration inequalities

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In the modern era of high and infinite dimensional data, classical statistical methodology is often rendered inefficient and ineffective when confronted with such big data problems as arise in genomics, medical imaging, speech analysis, and many other areas of research. Many problems manifest when the practitioner is required to take into account the covariance structure of the data during his or her analysis, which takes on the form of either a high dimensional low rank matrix or a finite dimensional representation of an infinite dimensional operator acting on some underlying function space. Thus, we propose using tools from the concentration of measure literature to construct rigorous descriptive and inferential statistical methodology for covariance matrices and operators. A variety of concentration inequalities are considered, which allow for the construction of nonasymptotic dimension-free confidence sets for the unknown matrices and operators. Given such confidence sets a wide range of estimation and inferential procedures can be and are subsequently developed.

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