1154-60-1663        **Shan Shan\*** (`sshan@math.duke.edu`), **Douglas M Boyer**, **Sayan Mukherjee** and **Ingrid Daubechies**. *Probabilistic models on fibre bundles.*

We propose probabilistic models on fibre bundles for learning the data generating process. The main tool is diffusion kernel and we used it in two ways. First, we build from diffusion kernel on fibre bundle a *projected kernel* that generates robust representations of data, and we test that it outperforms regular diffusion maps under noise. Second, the diffusion kernel gives rise to a natural covariance function when defining Gaussian process (GP) on fibre bundle. To demonstrate the uses of GP on fibre bundle, we apply it to simulated data on a M öbius strip for the problem of prediction and regression. For an example of real-world application, we use probabilistic models on fibre bundles to study the evolutionary process on anatomical surfaces, like teeth and bones. The proposed machinery, relating diffusion processes to probabilistic models on fibre bundles, provides a unified framework for ideas from a variety of different topics such as geometric operators, dimension reduction, regression and Bayesian statistics. (Received September 16, 2019)