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Peter Ebenfelt (pebenfel@math.ucsd.edu), Department of Mathematics, University of California at San Diego, La Jolla, CA 92093, **Dmitry Khavinson*** (dkhavins@usf.edu), Department of Mathematics and Statistics, University of South Florida, Tampa, FL 33620, and **Harold S. Shapiro** (shapiro@telia.com), Department of Mathematics, Royal Institute of Technology, S-10044 Stockholm, Sweden. *“Fingerprints” of the Two Dimensional Shapes and Lemniscates.*

The newly emerging field of vision and pattern recognition often focuses on the study of two dimensional “shapes”, i.e. simple, closed smooth curves. A common approach to describing shapes consists in defining a “natural” embedding of the space of curves into a metric space and studying the mathematical structure of the latter. Another idea that has been pioneered by Kirillov and developed recently among others by Mumford and Sharon consists of representing each shape by its “fingerprint”, a diffeomorphism of the unit circle. Kirillov’s theorem states that the correspondence between shapes and fingerprints is a bijection modulo conformal automorphisms of the disk. In this talk we discuss the recent joint work with P. Ebenfelt and Harold S. Shapiro outlining an alternative interpretation of the problem of shapes and Kirillov’s theorem based on finding a set of natural and simple fingerprints that is dense in the space of all diffeomorphisms of the unit circle. This approach is inspired by the celebrated theorem of Hilbert regarding approximation of smooth curves by lemniscates. We shall outline proofs of the main results and discuss some interesting function-theoretic ramifications and open questions regarding possibilities of numerical applications of this idea. (Received January 30, 2011)