1145-68-154   **Christopher John Tralie*** (`ctralie@alumni.princeton.edu`). *Topological Periodicity Analysis in Multimedia Time Series.*

A large variety of multimedia data inference problems require analysis of repeated structures. In audio, for instance, understanding rhythm is an important preprocessing step in music information retrieval. In medical video analysis, there is interest in determining heart pulse rate in ordinary webcam videos, analyzing stereotypical repetitive motor motions in videos of autism spectrum disorder patients, and analyzing voice pathologies from high speed videos of vocal folds. In this work, we show how the "shape" of time series can aid analysis in all of these applications. We present a unified sliding window framework in which periodic patterns show up as loops and quasiperiodic patterns show up as flat tori. We also show that some periodic processes with harmonic structures lie on loops which bound twisted spaces such as the Moebius strip, and quantifying these structures is applicable both to rhythm hierarchy analysis and detection of "biphonation" due to mucous in vibrating vocal folds. Finally, in addition to detecting and quantifying periodicity, we can parameterize periodic data, which we use both to analyze tempo/pulse rate and to create slow motion seamless templates of periodic time series and videos. (Received August 10, 2018)