

Detecting Unstable Periodic Orbits From Data Streams

Recurrent behaviour can often be explained by the presence of unstable periodic orbits (UPOs) in the underlying dynamics. Identifying these UPOs is then one method of characterising the system. For simple known systems these periodic orbits can be identified from the equations numerically. When the underlying equations are not known, or are too complex to be manipulated numerically, identifying UPOs must be done from observations.

A straightforward approach to identifying UPOs from experimental data is to consider the near returns of the data to itself. Trajectories initialised close to a UPO are expected to return close to their starting point. By observing the system for long enough one expects the system to approach a given UPO a number of times. This gives rise to a number of returning sections of trajectory that are themselves close to each other. At the outset we do not, and can not, know exactly how much data is required. To this end an algorithm that detects near returns and closely returning sections of trajectory from a potentially unending supply of data, i.e. a *data stream*, is presented.