

**ANALYSING DIRECTED, WEIGHTED NETWORKS USING
PERSISTENT HOMOLOGY**

S.M.K. Sakalasooriya^{1*} and A.K. Amarasinghe^{1,2}

¹*Department of Mathematics, Faculty of Science, University of Peradeniya, Peradeniya,
Sri Lanka*

²*Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka*
**kaushalyas@sci.pdn.ac.lk*

Persistent Homology (PH) is a powerful tool in topological data analysis, which can be used to interpret the shape of data. In recent times, PH was applied to analyse the structure of complex networks, revealing information that was hitherto unknown to mainstream network analysis techniques. The current research extends the use of persistent homology to directed, weighted networks to gain valuable insights into the underlying structure and dynamics of the network. The persistent landscape was obtained, a topological summary based on PH that is more pliable to statistical analysis, of a directed weighted network. To establish the pipeline from the network to its PL, Dowker source/sink filtration was applied to the network, producing the Dowker complex, then persistence homology was computed, and the data was used as the input for PH. Various non-interacting software are already established for the individual purpose, and through this study, a single pipeline from a weighted directed network was obtained. As an application, the average persistent landscape of a dataset that represents the global trade network was input to the pipeline. The results show that the potential of persistent homology as a valuable tool for understanding the global macroeconomic network.

Keywords: Dowker complex, Global macroeconomic network, Persistent homology, Persistence landscape, Topological data analysis