Unlocking Insights Into The Global Air Transportation Network With Tableau.

Abstract:

Almost half of the world's population is carried by airlines each year, and understanding this mode of transport is important from economic and scientific perspectives.

In recent years, the increasing availability of data has led to complex network and agent interaction models which attempt to gain better understanding of the air transport network and develop forecasts.

In this case study paper, we review existing research on two key approaches, namely:
(1) a top-down multi-scale network science approach, and
(2) a bottom-up entropy-maximization interaction network approach.

Using simple socioeconomic indicators, we were able to construct a very accurate interaction model that can predict traffic volume, and the model can forward estimate the impact of population growth or fuel cost. Using network science approaches, we were able to identify community structures and relate them to economic outputs.

Introduction:

Air transport networks are complex networks that span across multiple distance scales (from a few km to 10,000 km) and multiplex together over 5000 airline operators and has strong inter-dependencies with socioeconomic drivers.

The air transport network carry 3.5 bn passengers per year and generate over 30 m jobs globally. The analysis of air transport networks to better understand its network properties goes back for over 10 years [1,2,3,4].

Bottom-up entropy-maximization interaction model, which considers consumer choice;

The former gives a complex and detailed understanding of how spatial networks (i.e., flights) form from spatial processes (i.e., airports) and what the weight of each edge (i.e., passenger volume) is with respect to cost (impedes flow) and benefit (attracts flow) functions that relate to consumer behaviour.

Conclusions:

Almost half of the world's population is carried by airlines each year, and understanding this mode of transport is important from economic and scientific perspectives.

In this case study paper, we reviewed both bottom-up (max. entropy agent model) and top-down (network science) approaches to better understand the fundamental science behind air transport networks.

In Sect. 2.2, using simple socioeconomic indicators, we were able to construct a very accurate entropy-maximization interaction model that can predict traffic volume for Australia.

Future research will integrate the flow dynamic data into the complex network analysis, which can be done either explicitly through differential equation models [42] or using passenger flow data as a proxy [43].

References:

1.Guimera R, Amaral L (2005) The worldwide air transportation network: anomalous centrality, community structure, and cities' global roles. Proc Natl Acad Sci: PNAS 102:7794–7799

2.Zanin M, Lillo F (2013) Modelling the air transport with complex networks: a short review. Eur Phys J Spec Top 215:5–21

3.Verma T, Araujo N, Herrmann H (2014) Revealing the structure of the world airline network. Sci Rep 4:5638

4.Zhou Y, Wang J, Huang G (2019) Efficiency and robustness of weighted air transport networks. Transp Res Part E Logist Transp Rev 122:14–26