

Research Article

Robustness Analysis of the Regional and Interregional Components of the Weighted World Air Transportation Network

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The robustness of a system indicates its ability to withstand disturbances while maintaining its properties, performance, and efficiency. There are plenty of studies on the robustness of air transport networks in the literature. However, few works consider its mesoscopic organization. Building on the recently introduced component structure, we explore the impact of targeted attacks on the weighted world air transportation network on its components. Indeed, it contains five local components covering different regions (North America-Caribbean, Europe-Russia, East and Southeast Asia-Oceania, Africa-Middle East-Southern Asia, and South America) and one global component linking these regions. We investigate targeted attacks based on influential weighted centrality measures (strength, betweenness, and PageRank). Results show that the local components gradually separate from the world air transportation network as the fraction of removed airports grows. The weighted betweenness attack removes fewer top airports to isolate the regions compared to its alternatives. Furthermore, it is still convenient to travel locally in the separate areas. In contrast, strength and PageRank attacks need to target more airports to split the network. However, they are more disruptive. Indeed, the size of the isolated local components reduces drastically, so it becomes more challenging to travel locally. Looking at the world air transportation network through its component structure reveals a new viewpoint on its resilience. It opens new perspectives to design more efficient attacks.

1. Introduction

The air transportation network is essential for the development and integration of countries. Indeed, millions of people and tons of frets from different world regions pass through the air. Ensuring secure and effective air transport infrastructure and traffic is a vital issue. The complex network paradigm allows for a better understanding of an extensive range of complex in-interconnected systems such as infrastructure, economics, and social networks [1]. Considering the air transportation networks where nodes represent airports and links are flights between two airports, network robustness is a popular tool to study the response to possible disruptions. Disruptions can be accidents or intentional attacks on airports or flights. Numerous

investigations on the robustness of air transport networks (worldwide, regional, and national airlines) have been conducted [2–7]. In the following paragraph, we concentrate on targeted attacks based on centrality measures. It consists in ranking the airports according to a given centrality measure and removing the nodes in the descending order of their centrality value. The following paragraph summarizes some important related works.

In [8], the authors explore the robustness of the global air transportation network. They investigate five centrality measures (degree, betweenness, modal analysis, damage, and Bonacich power). They measure the effectiveness of the attacks using the size of the largest connected component (LOC). Indeed, the attacks split the network into multiple components. Results show that damage is most effective

Regional And Interregional Inputoutput Analysis An Annotated Bibliography

JA Banks



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