A Network Topology Analysis of Airlines ✈

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The Why and How

Data augmentation:

- Low cost
- Top Airlines
- Delay times

Extracting topology features & Applying ML

Understanding the results

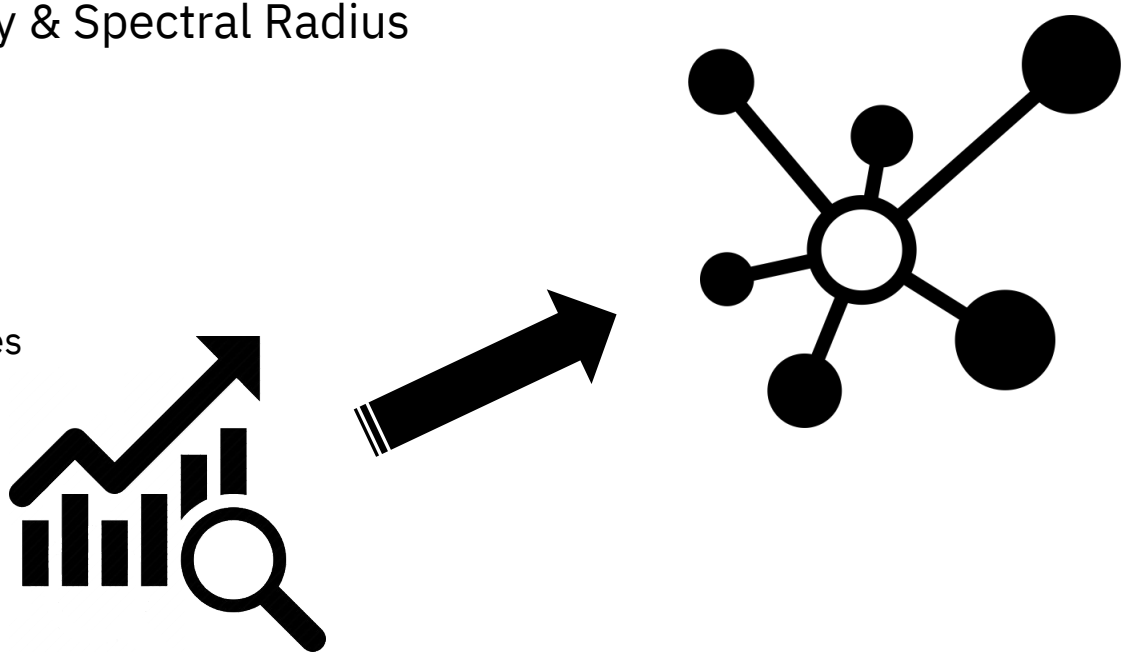
Applying knowledge gained

Data processing

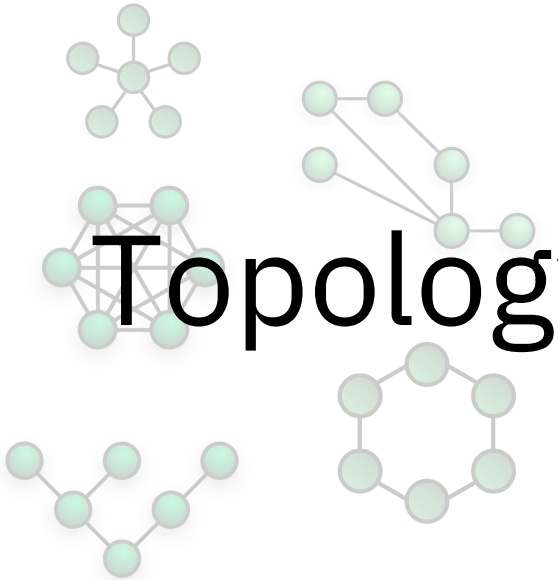
- Openflights:
  - Airports : 10/2006-01/2017
  - Routes : 10/2006-06/2014
  - Airlines : 10/2006-01/2012
- Low-cost carriers
- Top rated airlines
- Delay times

Network Metrics

- Algebraic Connectivity & Spectral Radius
- Spectrum Density
- Nodes Degree
  - % Degree-1 nodes
  - % Higher degree nodes
- Betweenness
  - Upper quantile
  - Median



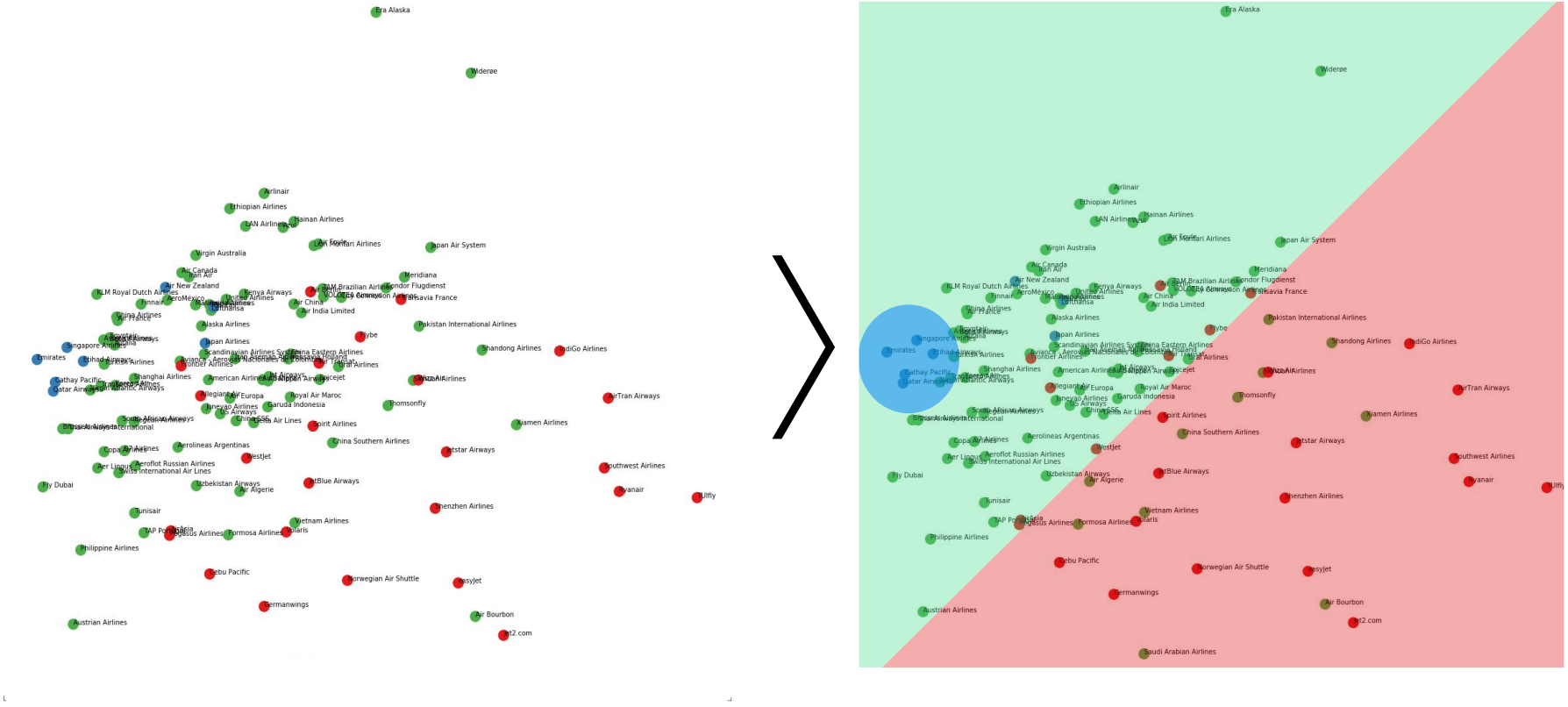
From Network to Average Delay



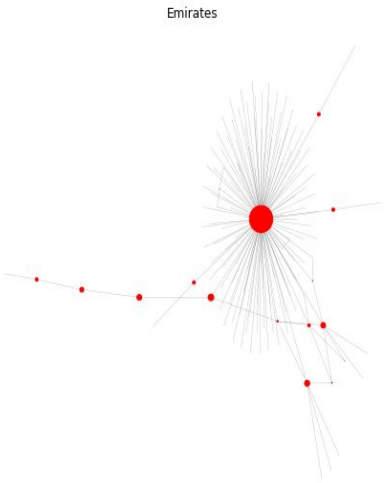
Topology

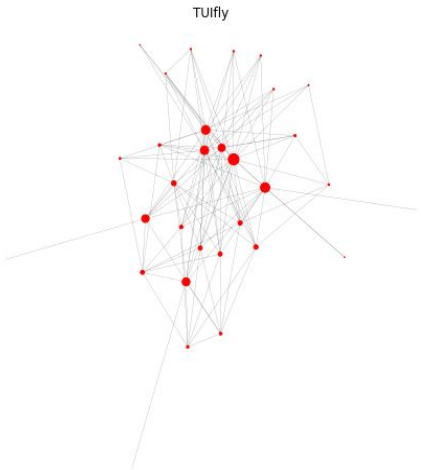
Delay

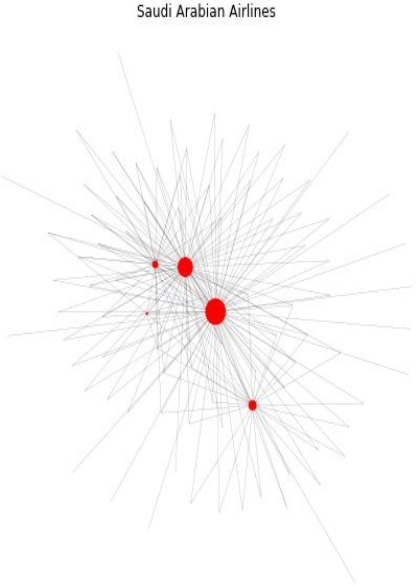
Results - Topology representation



Results - types of networks



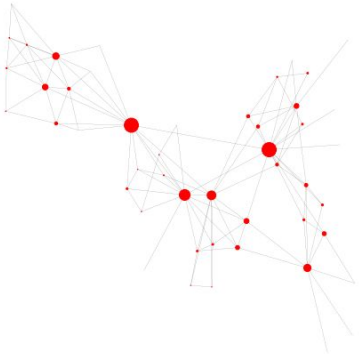


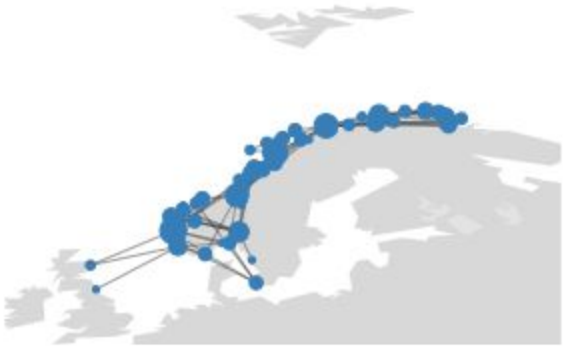


Results - Arctic Air Travel

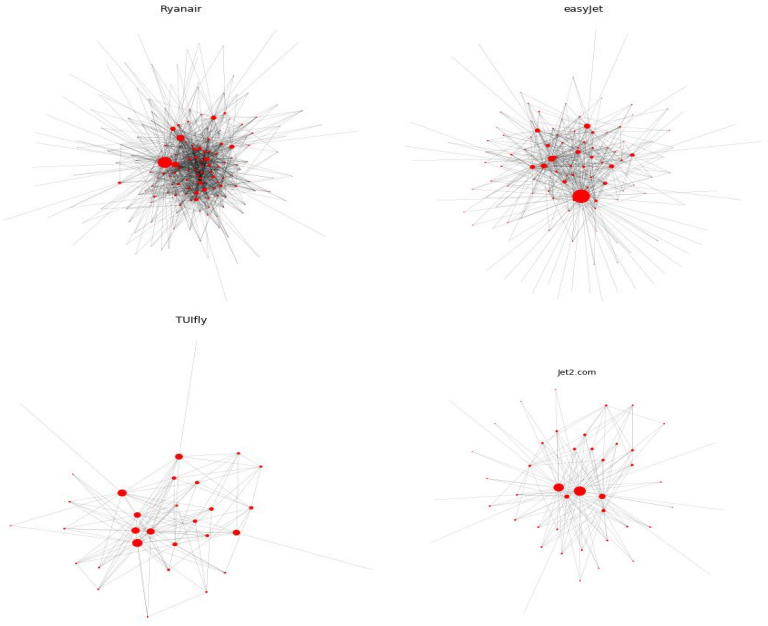
Usage influences structure

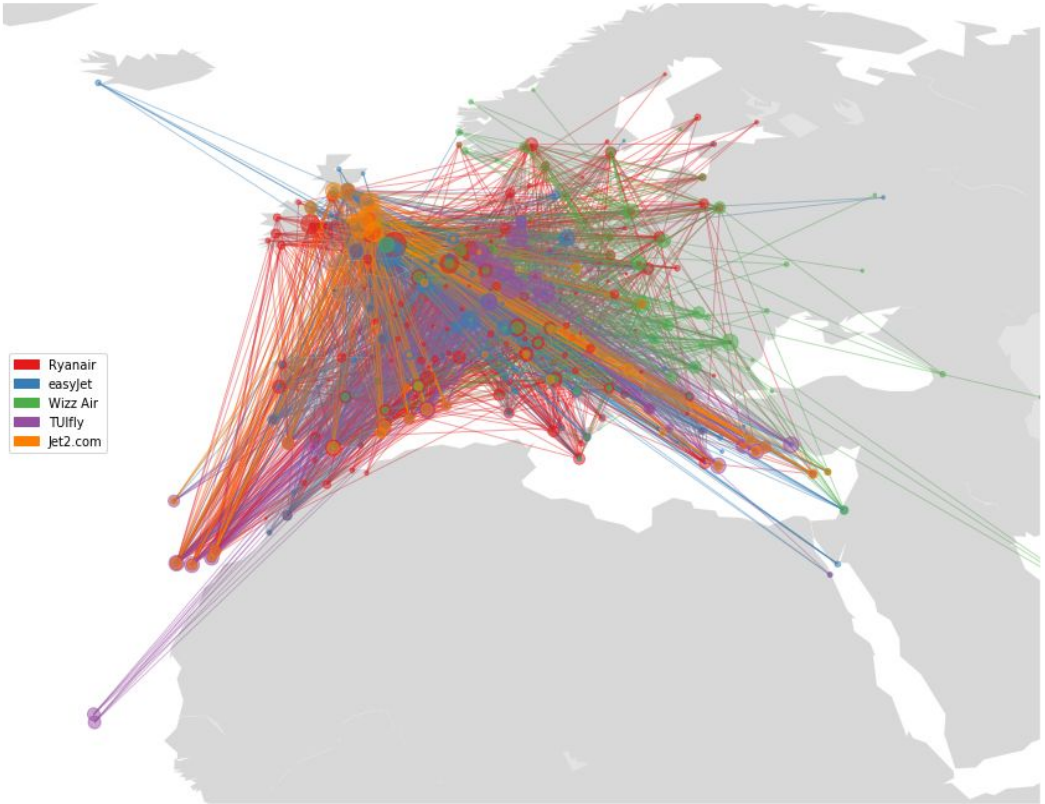
- Main form of transportation
- Village not accessible by road
- Read network like structure



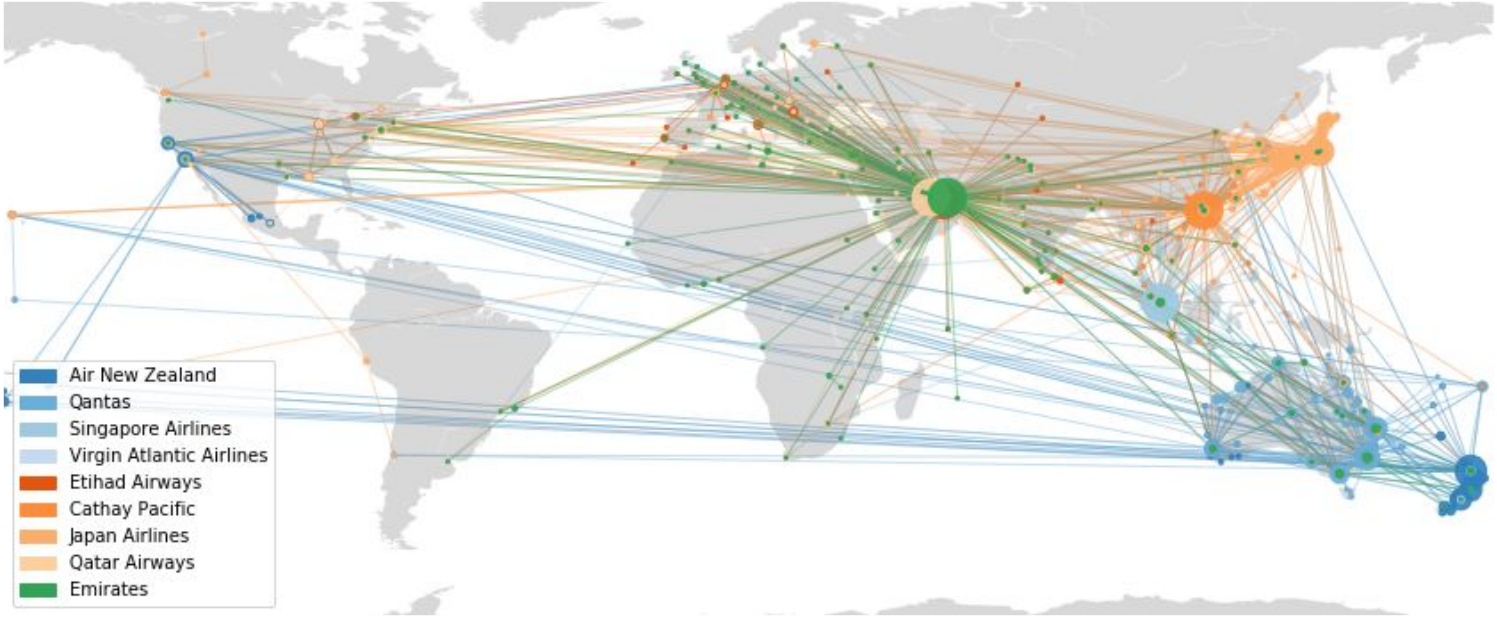


European budget travel





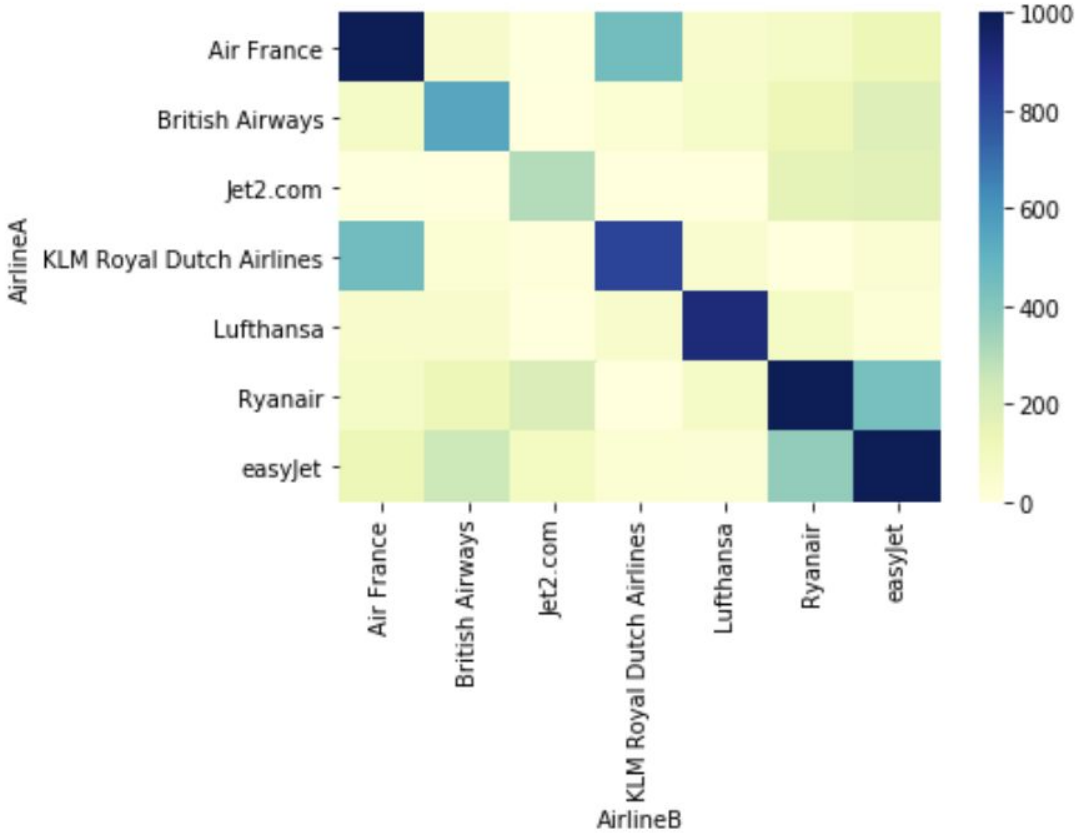
Results - Topology representation



Competition

- Score based-algorithm
- Considers airports that are **close by** (distance less than 100 km)
  - For each pair of routes in the two airlines:
    - Increase the score with **1** if the source **and** destination airports are **less than** 100 km apart
- **Asymmetric**
- Can be scaled by the number of total routes

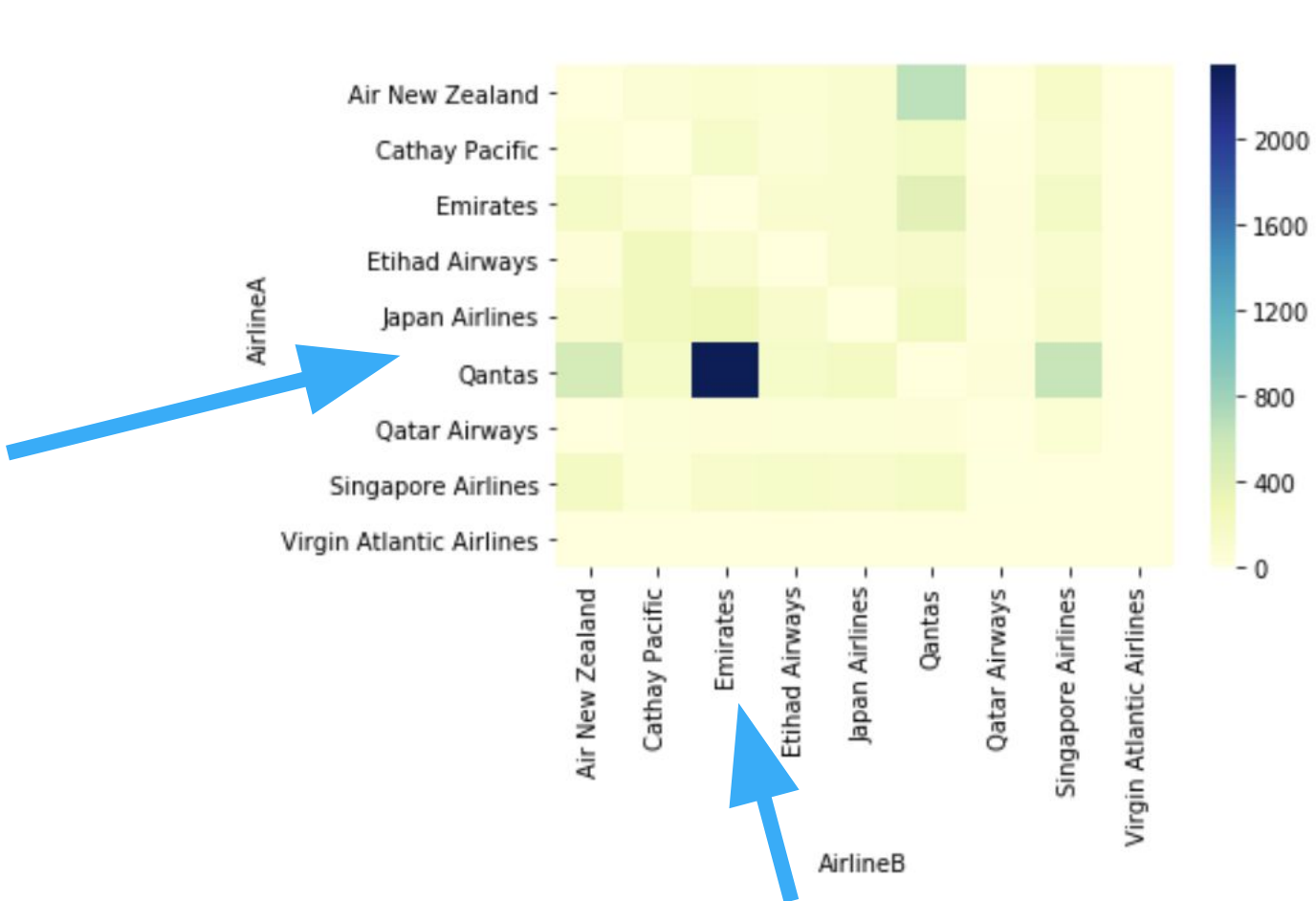
Competition Scores



Collaboration

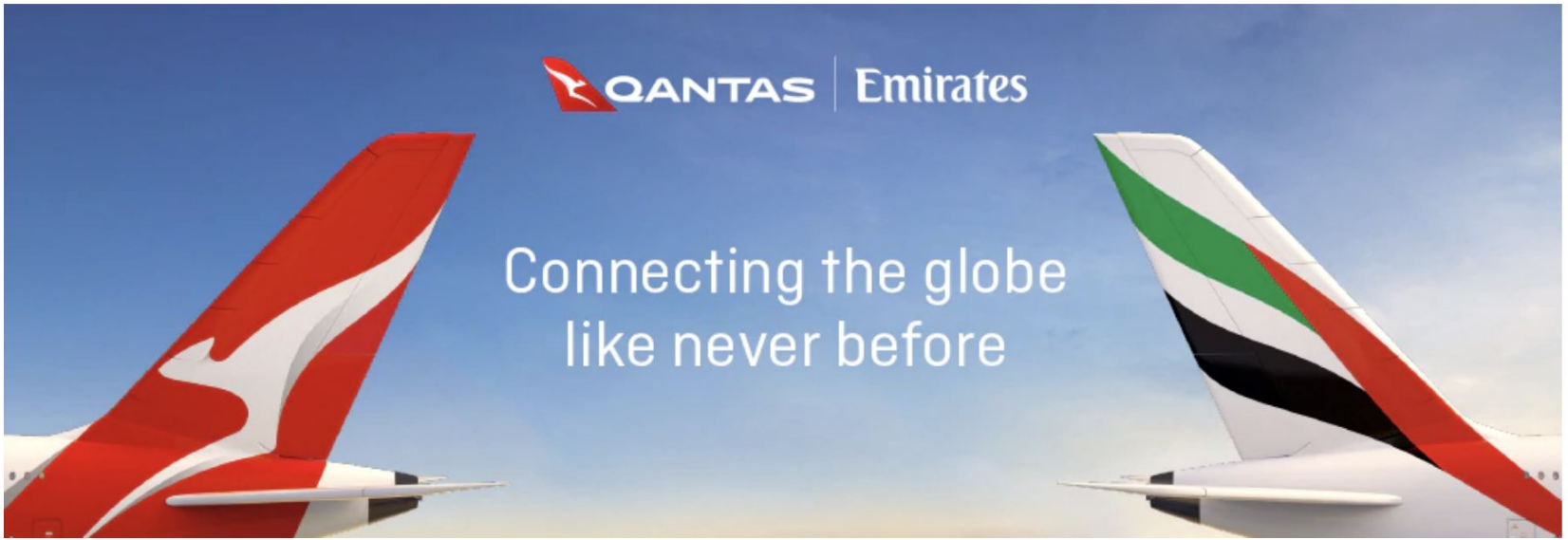
- Score-based algorithm
- **Completion score**
  - How well an airline is “**completed**” by another airlines?
  - Filling the gaps of airlines
- How many **new** destinations **Airline A** can cover if it partnerships with **Airline B**

Partnership found!

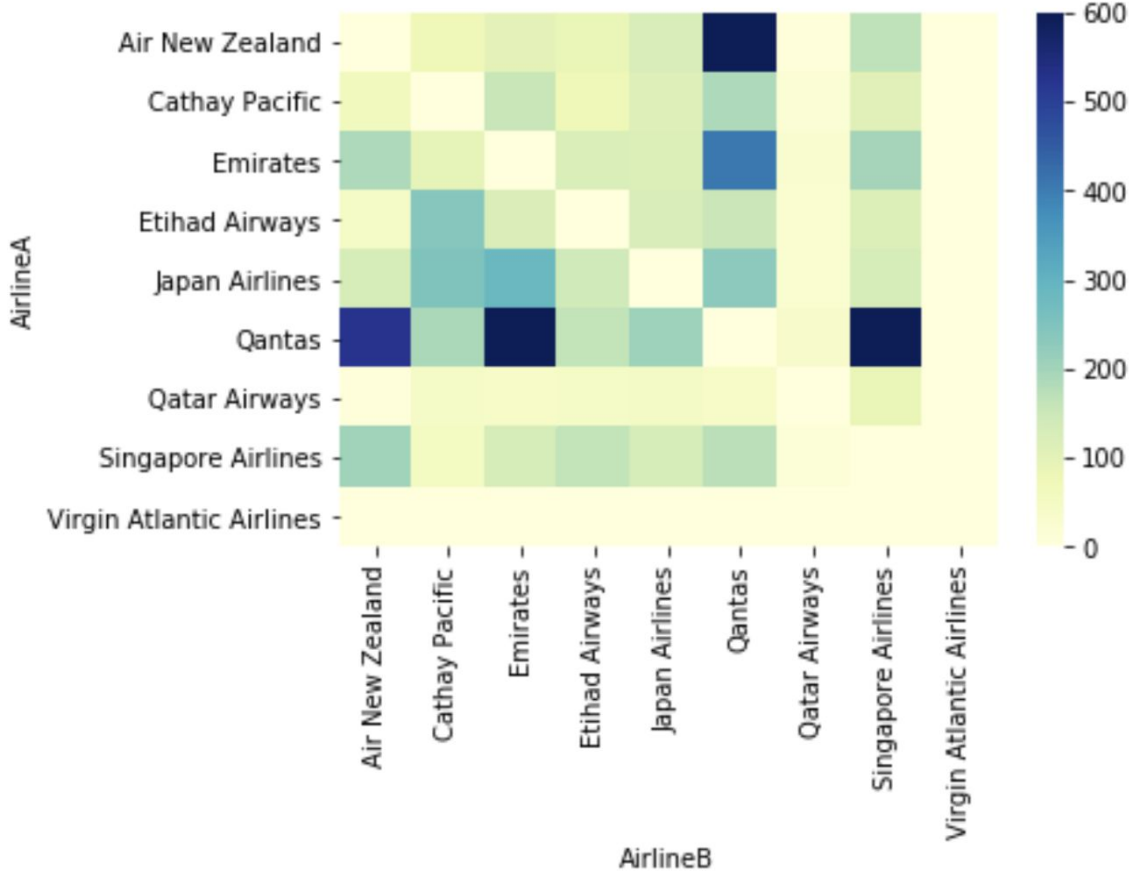


Qantas and Emirates

Together connecting the globe like never before



Collaboration scores



Conclusion

- The few topological features we had were very useful
- Find other potential correlations with topology