STAT 992 Project Proposal

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Data:
Medicare Physician and Other Supplier NPI Aggregate table & Physician Referral Networks

Features of Interest

- Provider Type: Internal Medicine, Family Practice, Nurse Practitioner, Cardiology, Psychiatry...
- Zip-codes: geographic representations
- Medicare Payment Amount
- Patients Characteristics: age, gender, race, disease...

- ➢ Network representations
- ➢ Graph Properties
- ➢ Clustering Techniques
- ➢ Statistical Network Models
- ➢ Connection with Medicare data

Exploratory Analysis

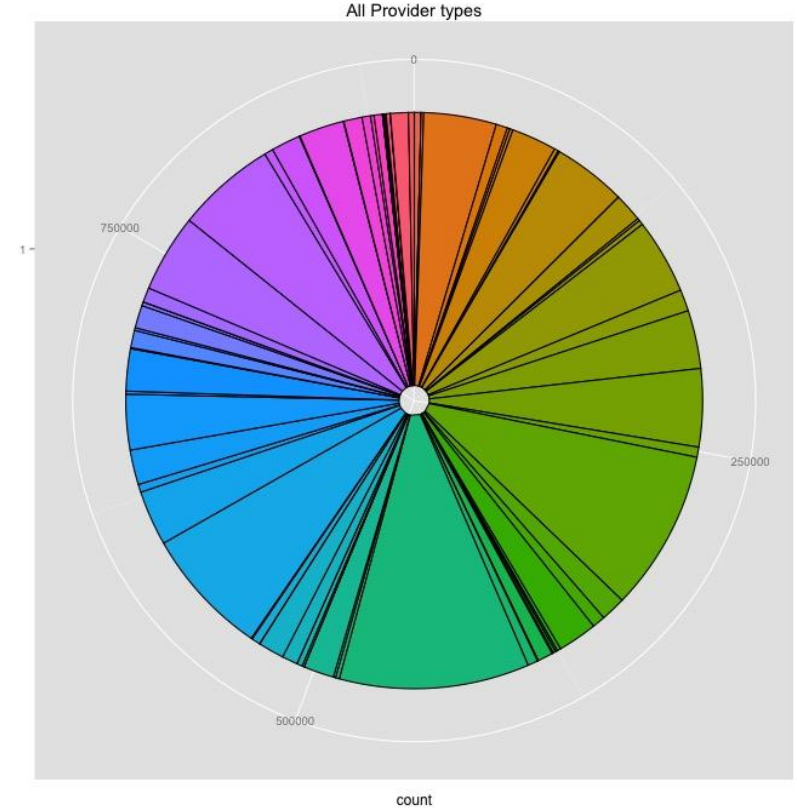
Looking for valuable problems for future exploration

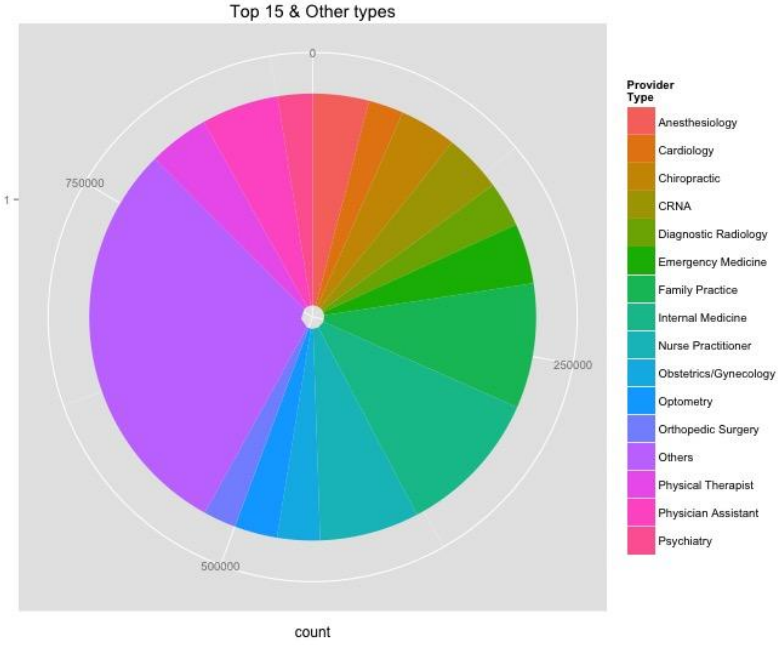
- Data Visualizations
- Zip-code Analysis of the Network Clusters
- Exploring Medicare Payments
- Exploring Provider Types

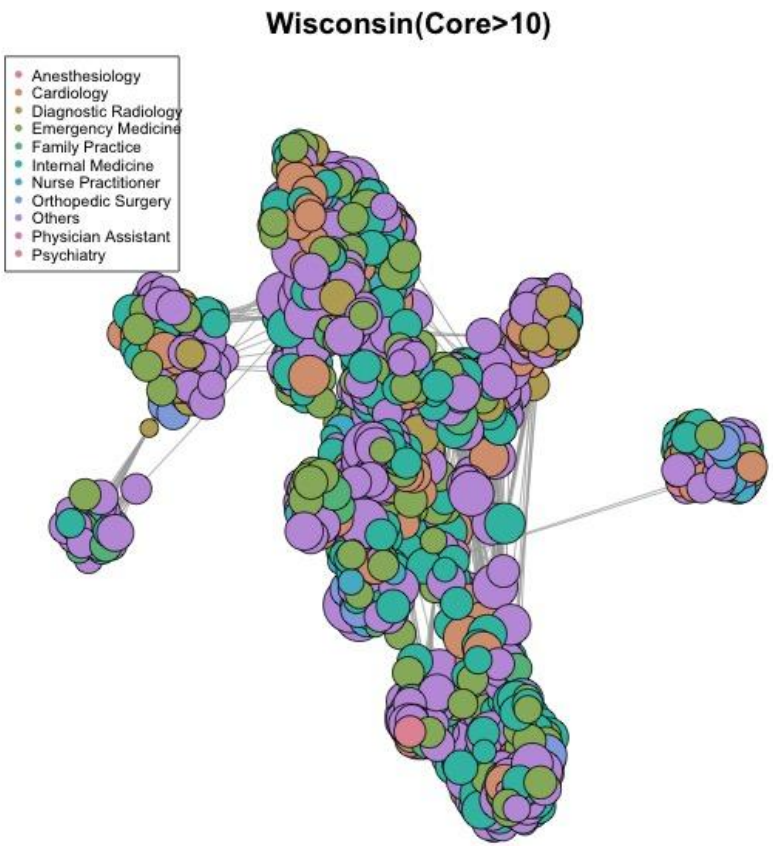
Top 10 highest Medicare Payment Provider Type

Cardiology	Ambulance Service Supplier	Cardiac Electrophysiology	Cardiac Surgery	Allergy/Immunology
219019.644	209516.273	200051.820	171564.990	63490.806
Addiction Medicine	Anesthesiology	All Other Suppliers	Anesthesiologist Assistants	Audiologist (billing independently)
50167.914	44109.187	18207.955	14645.075	7708.904

- 84 Different Provider Types
- Select top 15 most common types which accounts for almost 75% of all

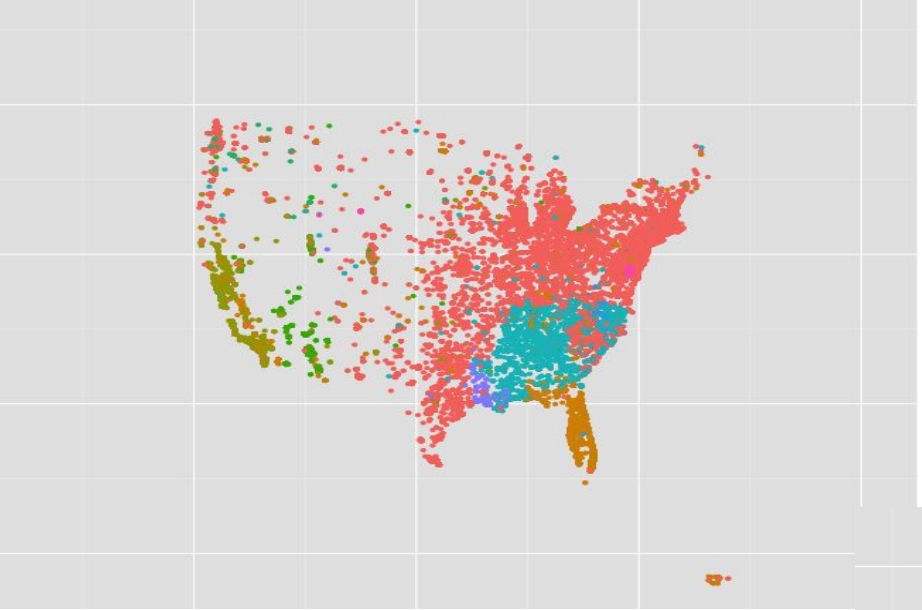




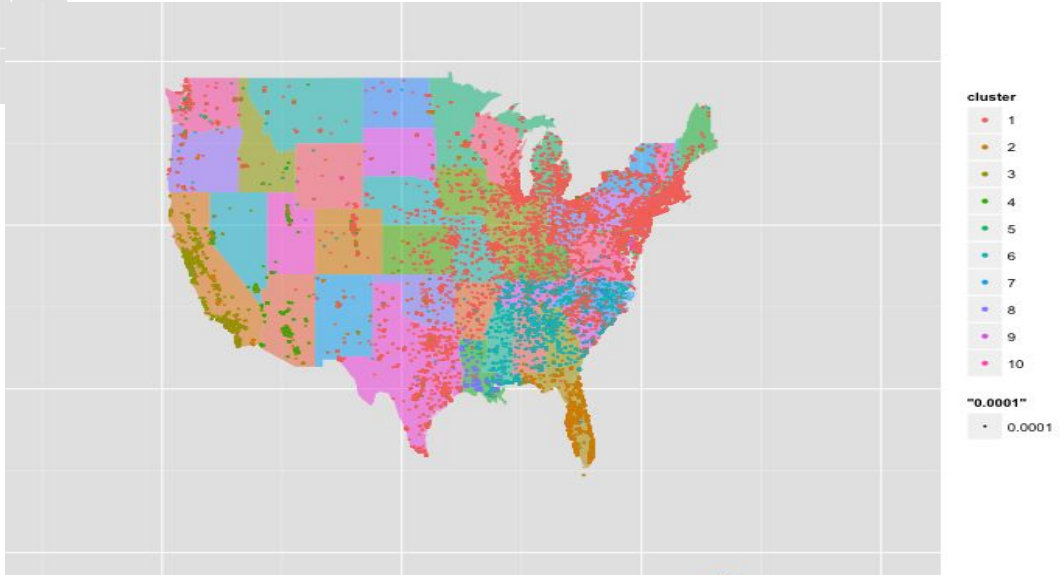


- Vertex size proportional to its Medicare Payment Amount
- Payment of family practice varies drastically

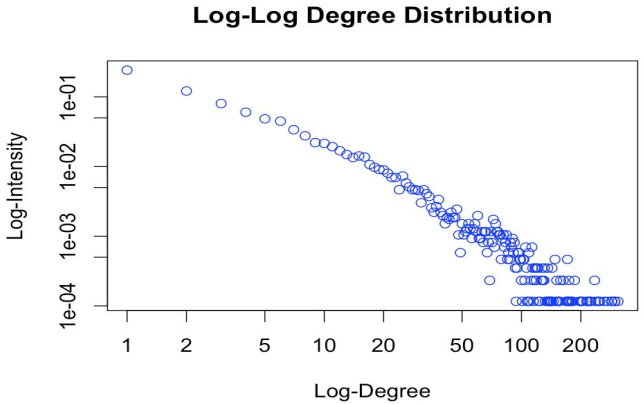
What do clusters look like geographically?



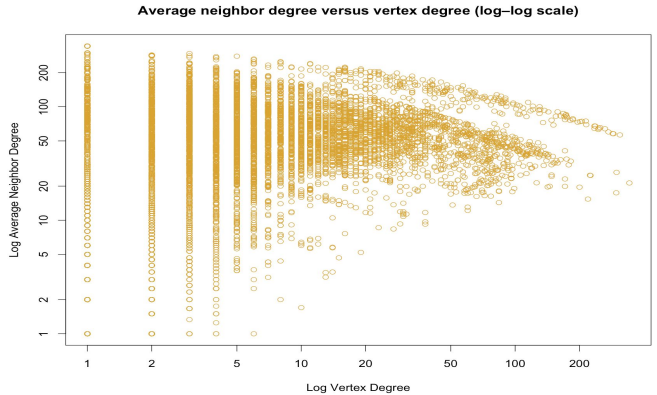
Observations in same cluster tend to locate geographically closer to each other.



Graph property: degree (Wisconsin as an example)

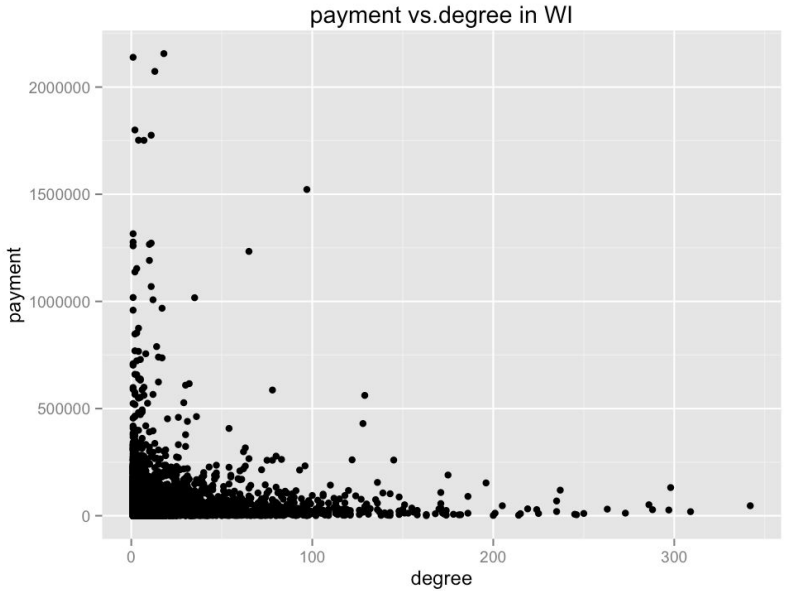


Fairly linear decay

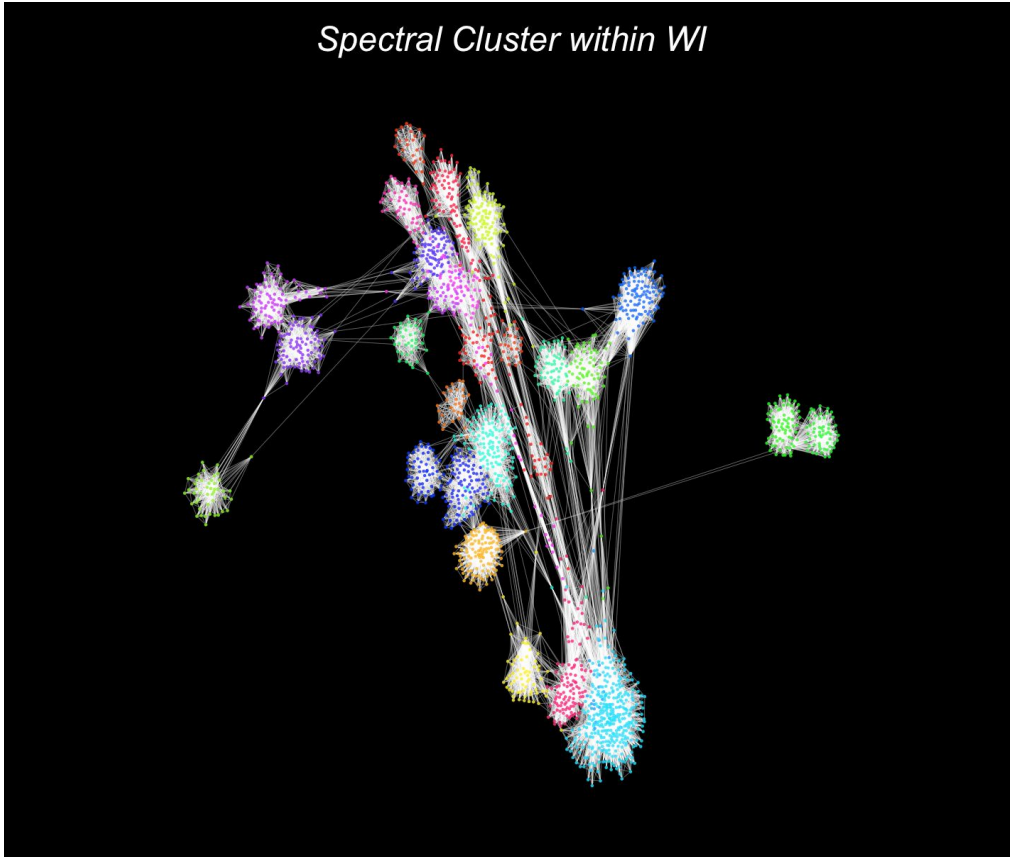


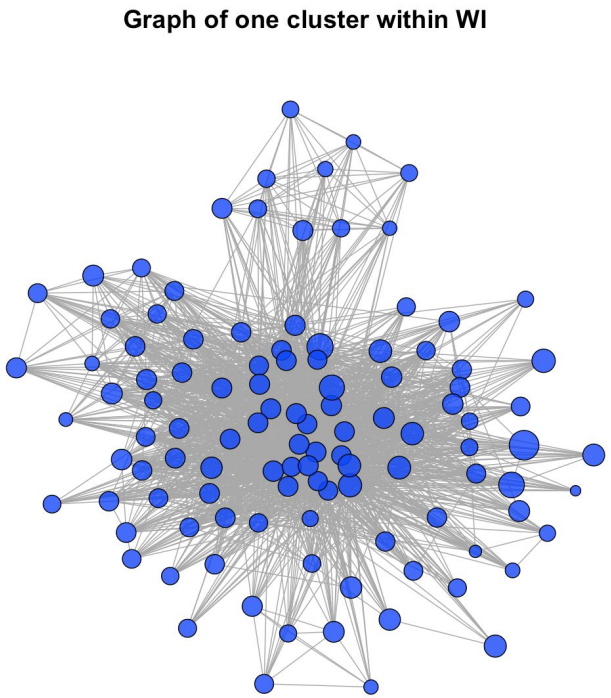
Vertices: higher degrees link with similar, lower degree link with both

Relationship with Total Medicare Payment Amount

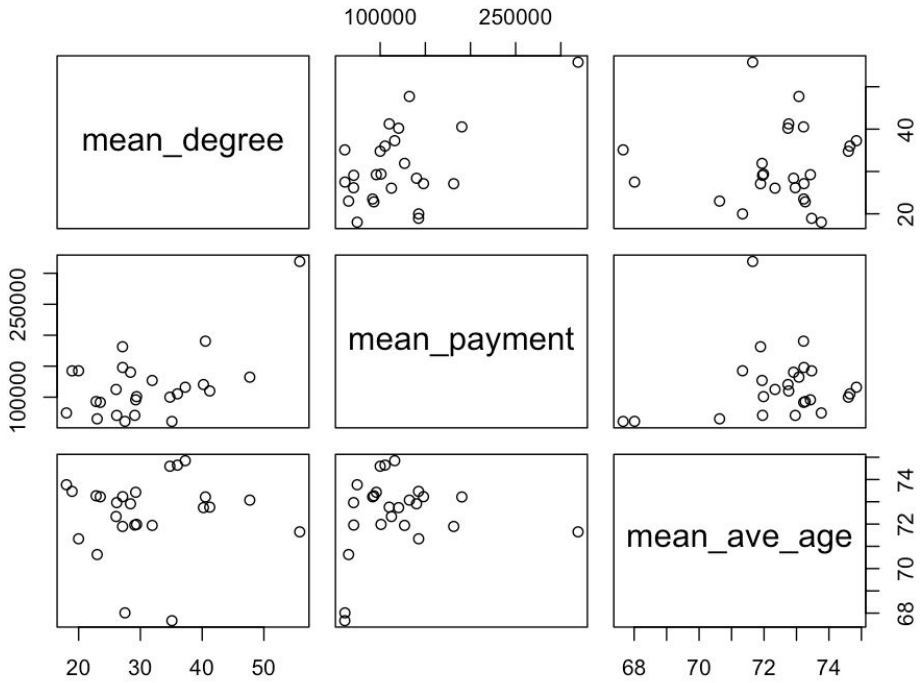


Spectral Clustering





Obtain summary measures of the networks in each cluster



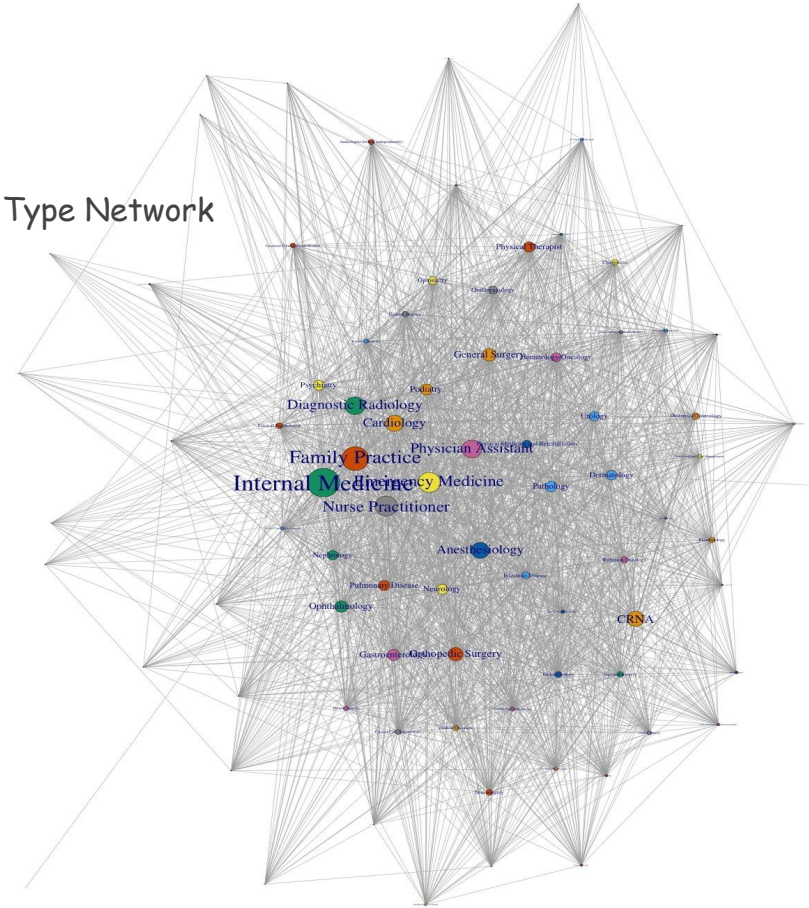
y:mean_payment	Estimate	P-value
x:mean_degree	3223	0.00571

In the future:
Larger area
More variables
Control provider type

Visualizing the National Referral Network

Based on the Provider Type of Physicians

Provider Type Network



- Our Goal: Clustering and Modelling
- The plot is quite busy. How could it be improved?
  - Ongoing: Weighted Edges
  - Cutting Thin Edges
  - Removing Unimportant Vertices

By the end of the project, you may see…

- Better Visualizations
- Geographical Representation of Clusters
- Statistical Inference for Clusters
- Further Studies on Medicare Payments and Provider Types
- … …