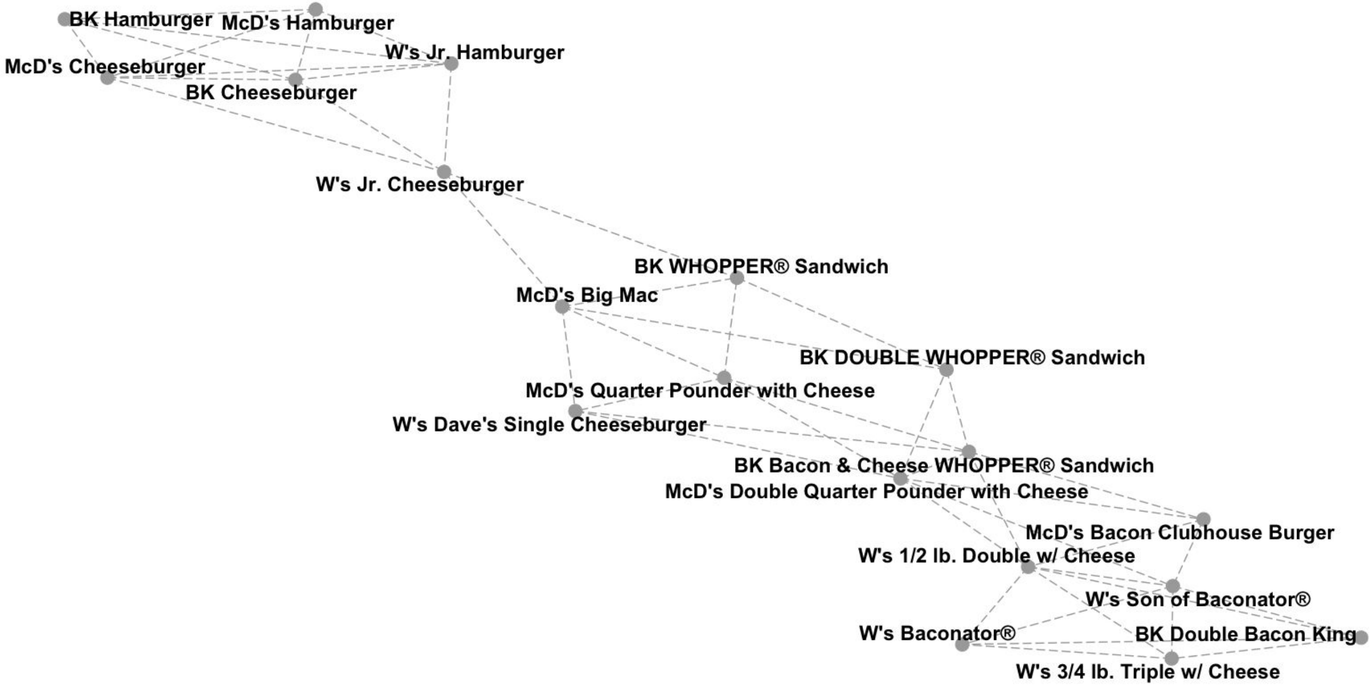
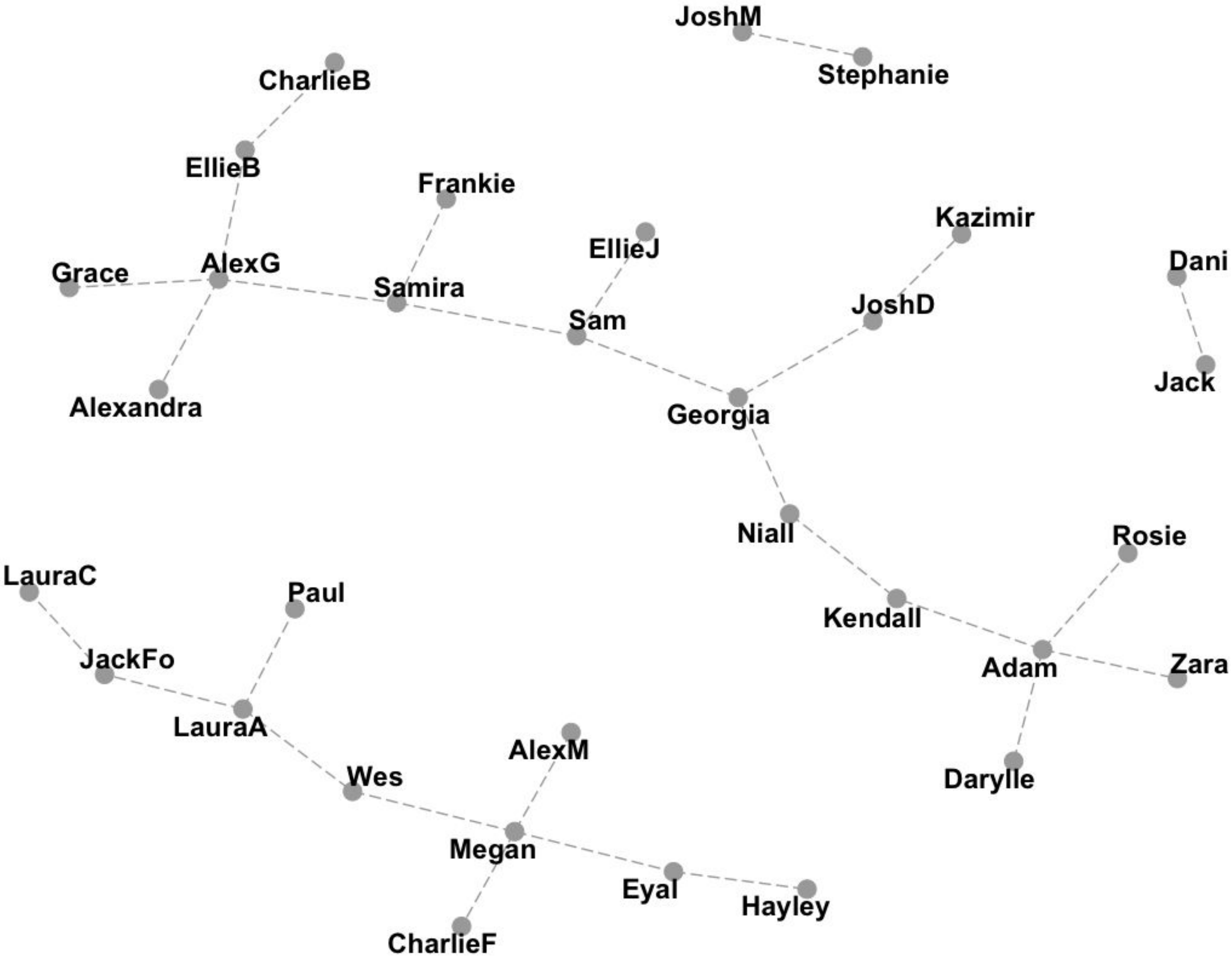
Topics In Data Science

Chelsea Parlett-Pelleriti

Node Based Resilience Clustering


BK Hamburger
McD's Hamburger
W's Jr. Hamburger
McD's Cheeseburger
BK Cheeseburger
W's Jr. Cheeseburger
BK WHOPPER® Sandwich
McD's Big Mac
BK DOUBLE WHOPPER® Sandwich
McD's Quarter Pounder with Cheese
W's Dave's Single Cheeseburger
BK Bacon & Cheese WHOPPER® Sandwich
McD's Double Quarter Pounder with Cheese
McD's Bacon Clubhouse Burger
W's 1/2 lb. Double w/ Cheese
W's Son of Baconator®
W's Baconator®
BK Double Bacon King
W's 3/4 lb. Triple w/ Cheese


JoshM
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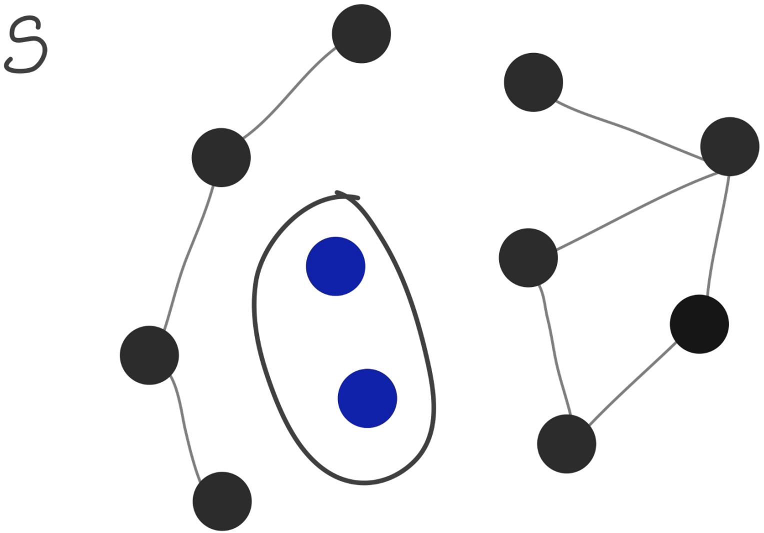
CharlieB
EllieB
Frankie
EllieJ
Kazimir
Dani
Grace
AlexG
Samira
Sam
JoshD
Jack
Alexandra
Georgia
Niall
Rosie
LauraC
Paul
Kendall
JackFo
Adam
Zara
LauraA
AlexM
Darylle
Wes
Megan
Eyal
Hayley
CharlieF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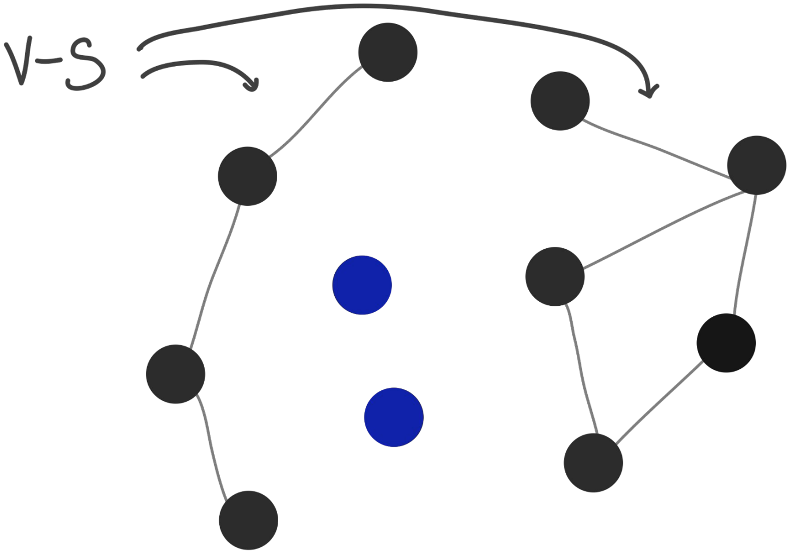
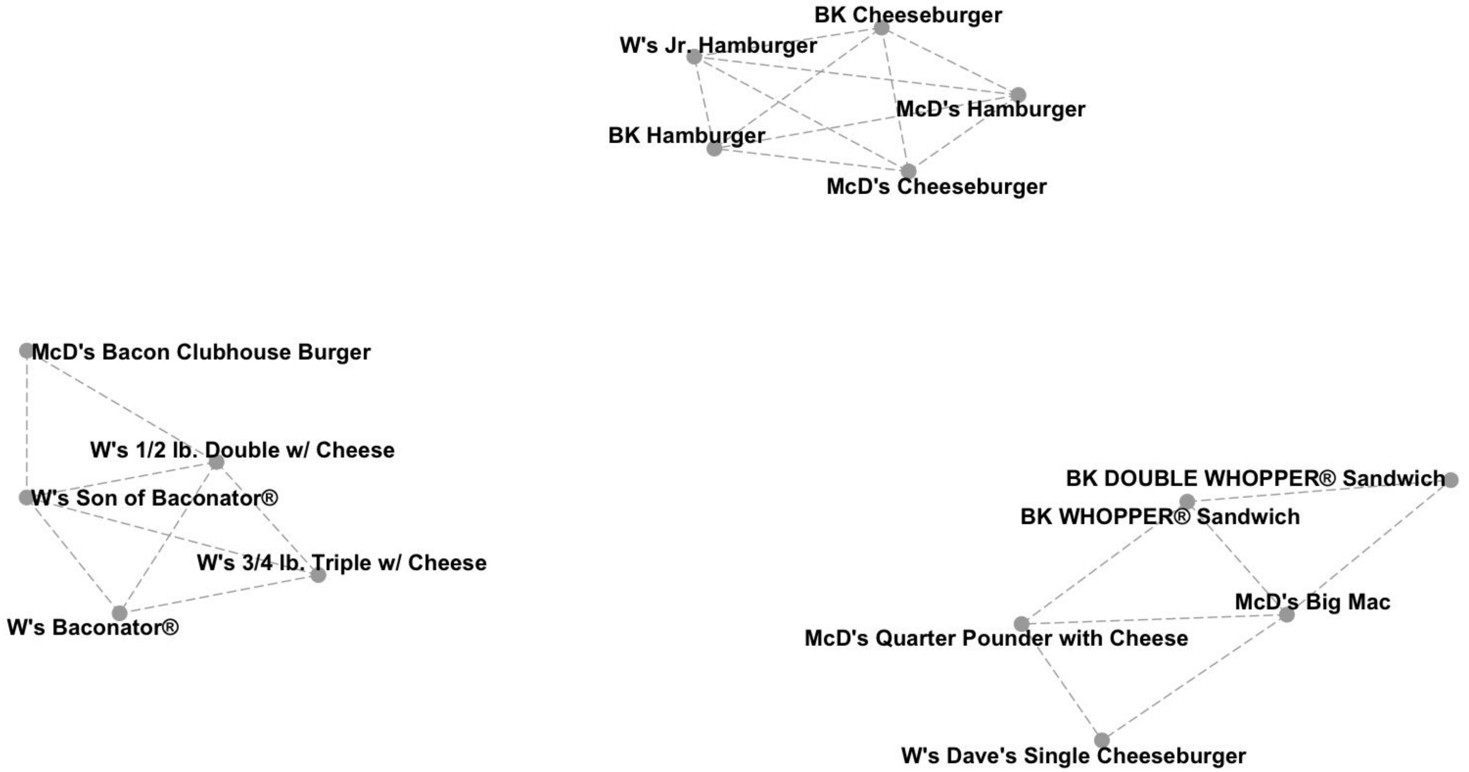

V-S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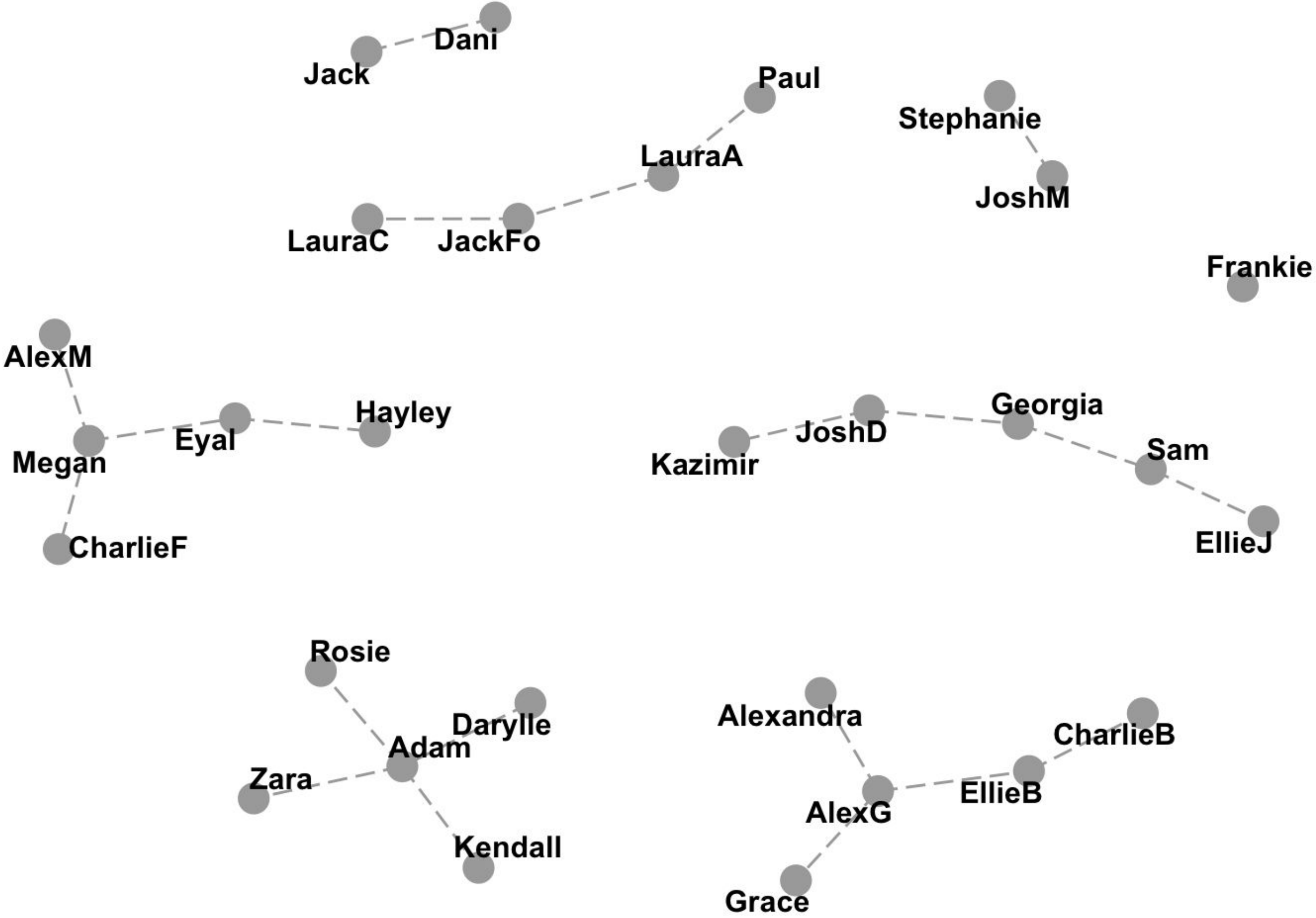
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Grace

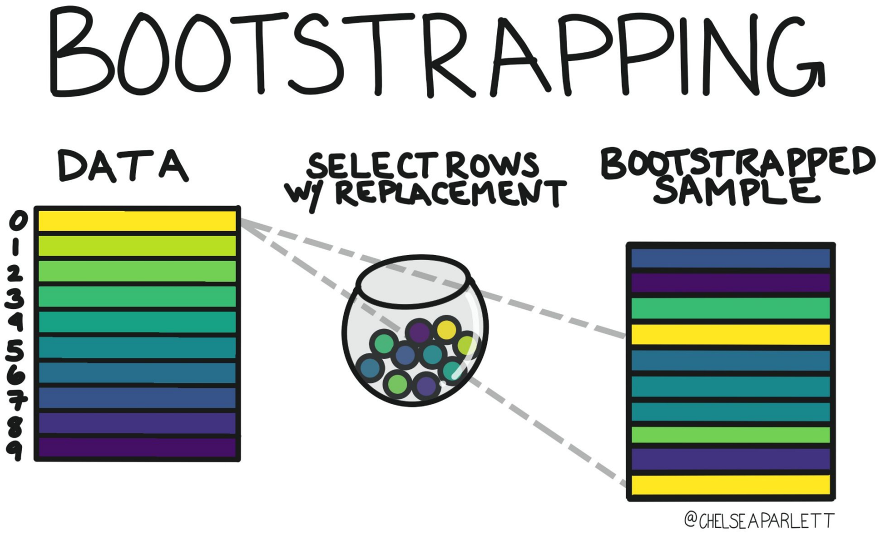
Ensemble Methods

ONE vs. MANY

Random Forest

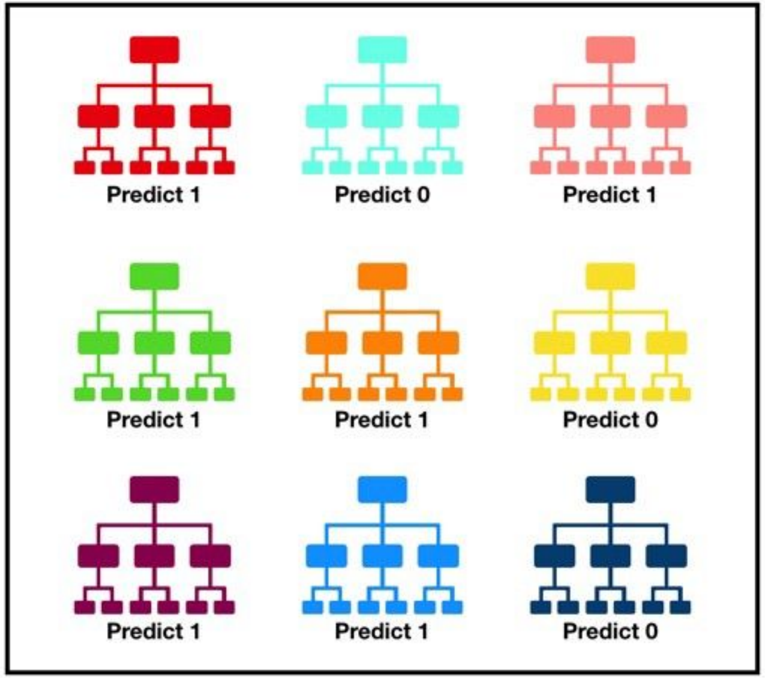
Random Forest

- **Bagging (Bootstrap Aggregating)**: Instead of using all of our training data to train each model in our sample we use **bootstrapping** to choose the samples (rows) we will include.
    - **Bootstrapping** is when you randomly sample data points *with replacement*, meaning that a data point can be included in your bootstrapped sample *more* than once, OR not at all.



Random Forest

- **Random Feature Selection**: Instead of using all the available *features/predictors* in our dataset for every model, for each model *we randomly choose a different subset of features to use* when training.
  - This helps our ensemble generalize, because it doesn't become overly reliant on one feature (since that feature might not appear in every model).



Bayesian Statistics

Bayesian Statistics

$$\underbrace{P(\theta\,|\,D)}_{posterior} \propto \underbrace{P(\theta)}_{prior}\,\underbrace{P(D\,|\,\theta)}_{likelihood}$$

Data + Expertise =

Inference

Bayesian Statistics

Data =

Inference

Bayesian Statistics

MINIMIZE:

$$\sum\Big(\overbrace{\underset{\substack{\uparrow\\\text{true}\\\text{value}}}{x_i} - \underset{\substack{\uparrow\\\text{model's}\\\text{guess}}}{\hat{x}_i}}^{\text{how off we were}}\Big)^2 + \underset{\substack{\uparrow\\\text{how HARSHLY}\\\text{we penalize}}}{\lambda}\sum \underset{\substack{\uparrow\\\text{how big the}\\\text{coefs are}}}{B_j}^{\boxed{2}}$$

MINIMIZE:

$$\sum\Big(\overbrace{\underset{\substack{\uparrow\\\text{true}\\\text{value}}}{x_i} - \underset{\substack{\uparrow\\\text{model's}\\\text{guess}}}{\hat{x}_i}}^{\text{how off we were}}\Big)^2 + \underset{\substack{\uparrow\\\text{how HARSHLY}\\\text{we penalize}}}{\lambda}\sum \underset{\substack{\uparrow\\\text{how big the}\\\text{coefs are}}}{|B_j|}$$

Bayesian Statistics

What we believed before + **Evidence from the data** =
New beliefs