Understanding the US Foundry Industry

DS-SF-30
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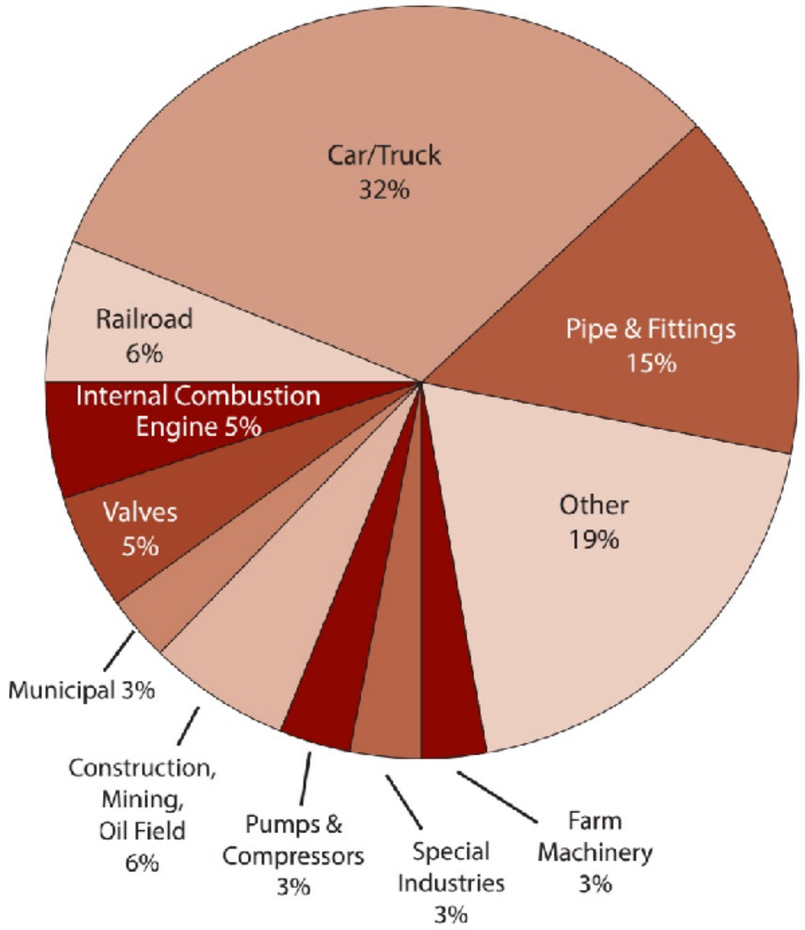
Introduction

“It’s impossible to make generalizations about the foundry industry.”

— Individual recovering from failed startup,
December 2016

The Metal Casting Industry



- $32 billion of castings sold in the US in 2014
- 12 million tons poured in 2014 in the US
- 90% of manufactured goods contain cast metal parts
- Rule of thumb: never more than 10ft from a casting

http://www.afsinc.org/about/content.cfm?ItemNumber=13450

Why is it Interesting?

- Qualified process
- Diverse materials
- Well-understood constraints
- Few scale and geometry constraints
- More economically feasible than most metal printing technologies
- Widely distributed infrastructure

Goals

- Extract high level demographic information (who, what, where)
- Identify most popular value add engineering processes
- Identify most widely poured alloys
- Develop a model for classifying foundry processes based on alloys poured
- Apply classwork

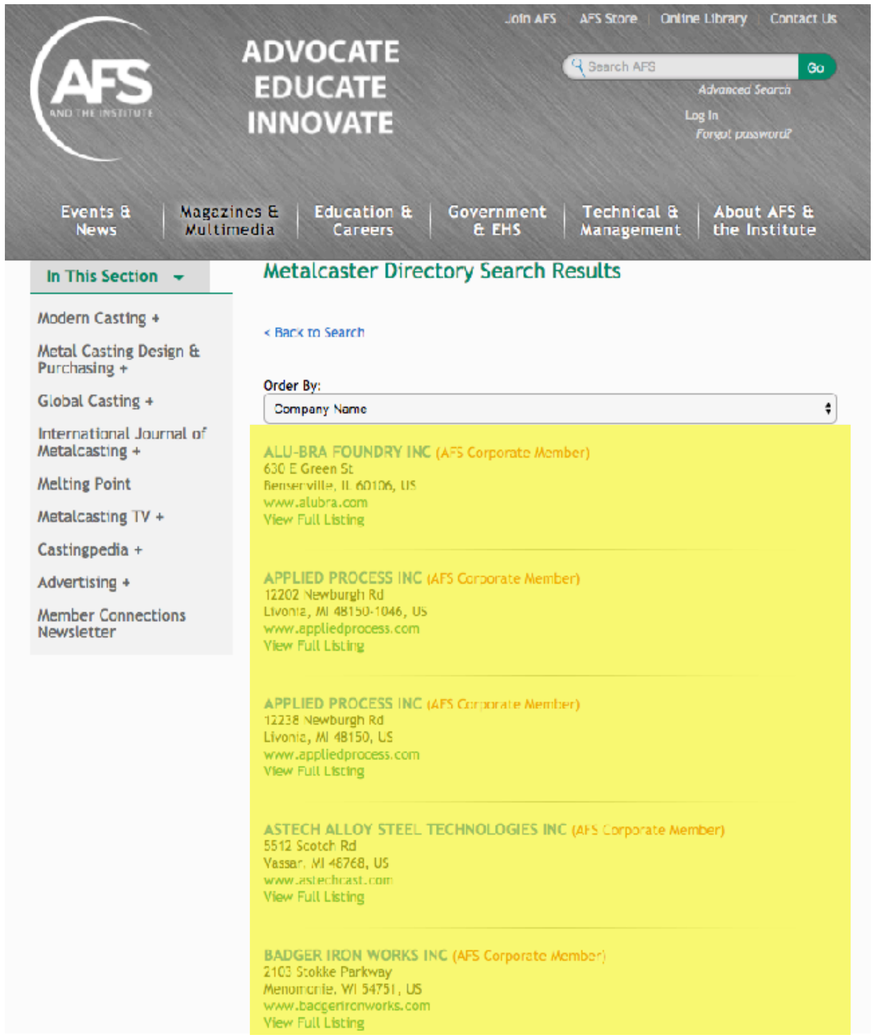
Modeling Approach & Data

Data Source:

American Foundry Society membership index records

Modeling Approach:

- Geographic plotting
- Correlations across categorical variables
- Logistic regression across alloys to categorize foundry type

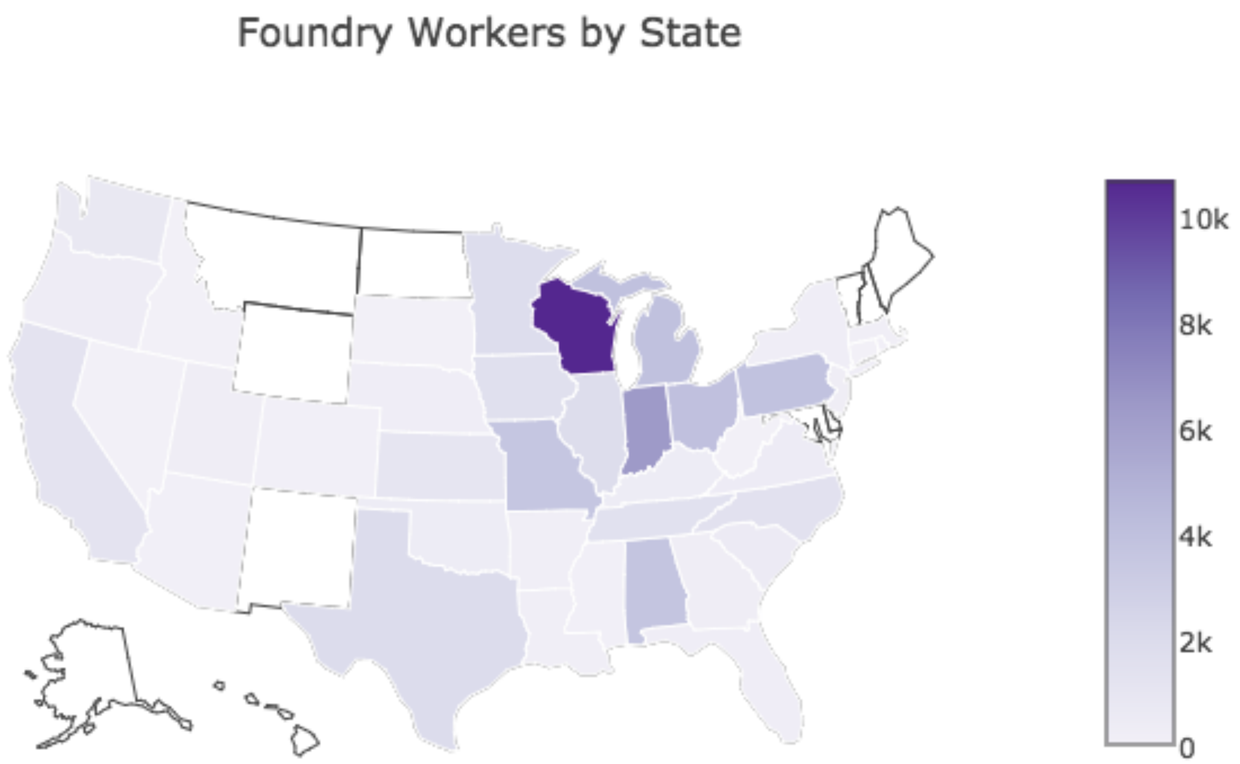


Data

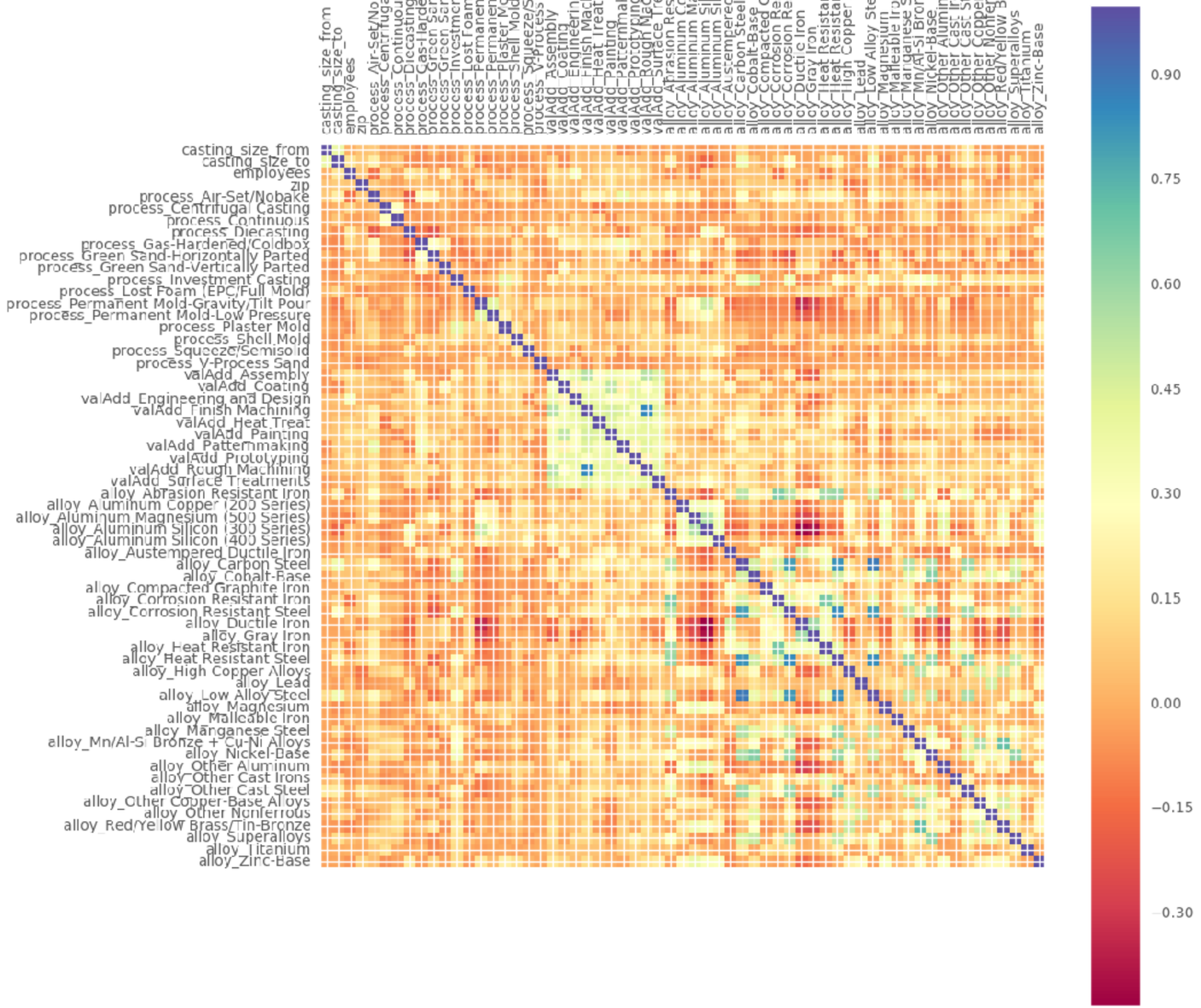
Feature	Type	Description
Name	String	Name of the company
Zip	Int, categorical	Zip code
State	String, categorical	State
Country	String, categorical	Country
Employees	Int	Number of employees
Casting Size (From)	Float	Smallest casting size serviced by foundry
Casting Size (To)	Float	Largest casting size serviced by foundry
Casting Processes	String, categorical	The different processes undertaken by the foundry
Metals	String, categorical	The different alloys poured by the foundry
Value Added Processes	String, categorical	Value add engineering processes offered by the foundry

High Level Insights

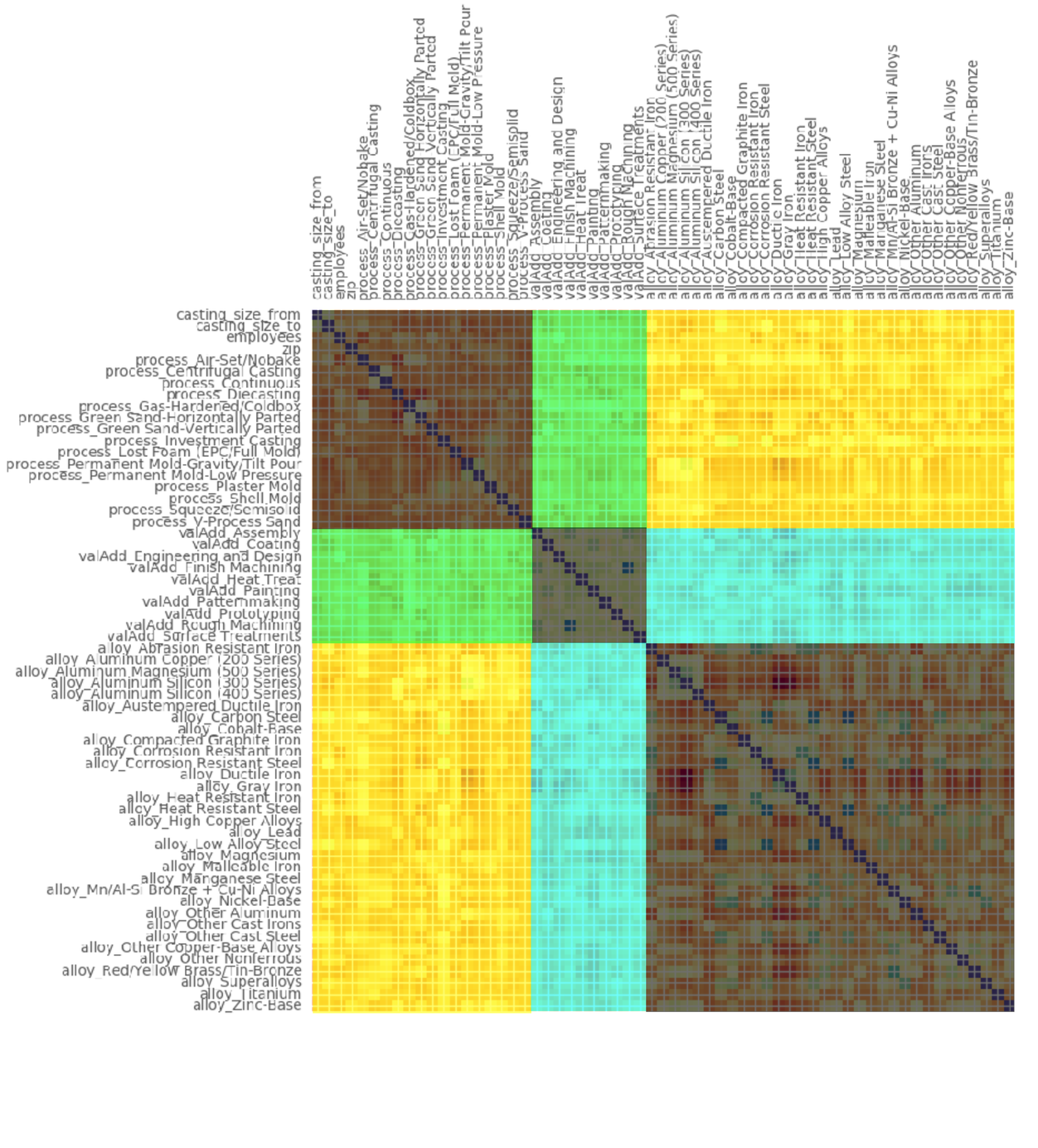
- Michigan hosts highest number of foundry workers
- Midwest closely behind
- Tracks Midwestern heavy industries (automotive mining, rail)
- Majority of industry is sand casting
- Most popular alloys are cast Ductile and Gray Iron



Process, Value Add Engineering, and Alloys: Insights



Process, Value Add Engineering, and Alloys: Insights

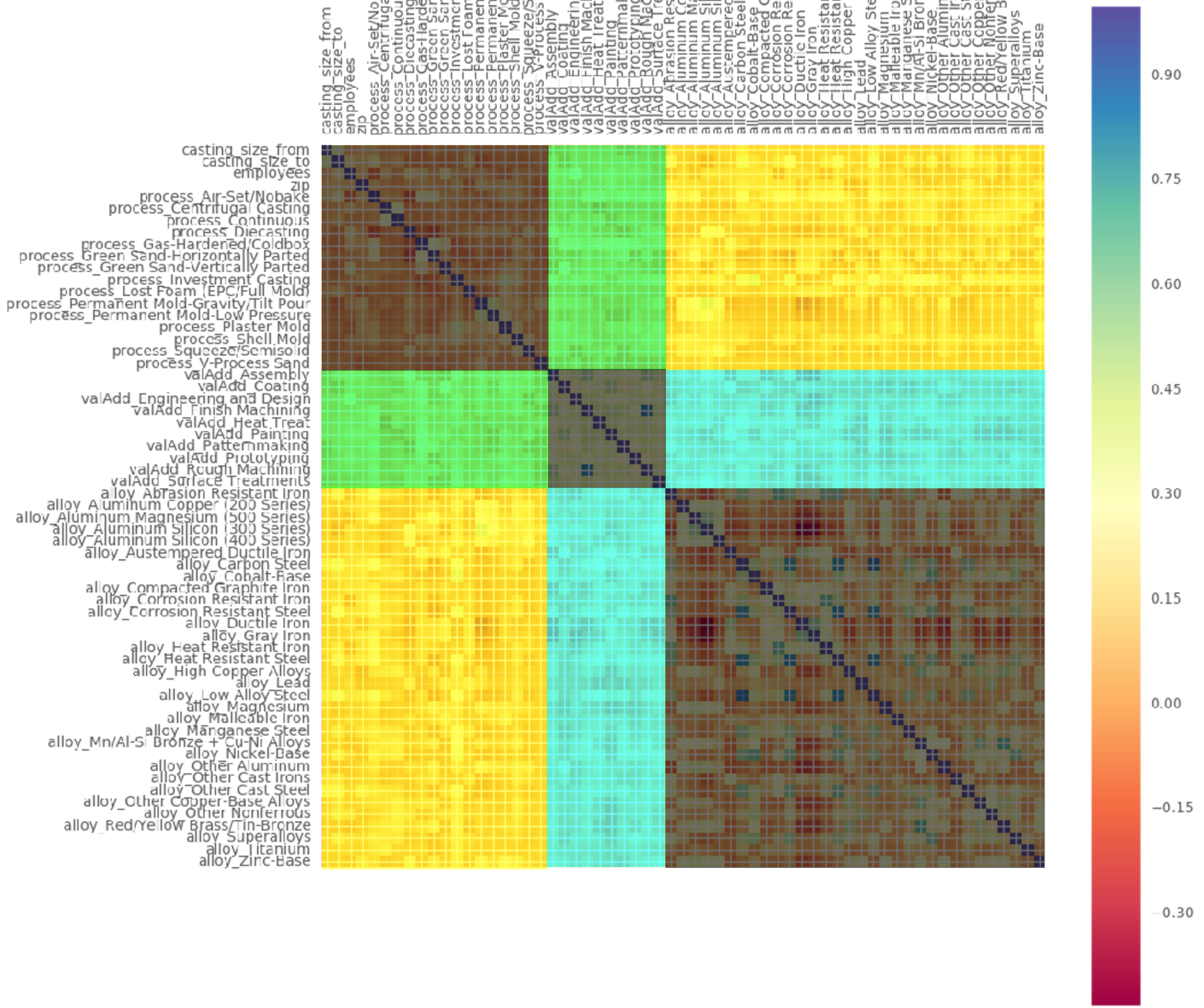


Casting process vs. value add engineering

Casting process vs. alloy

Value add engineering vs. alloy

Like vs. like



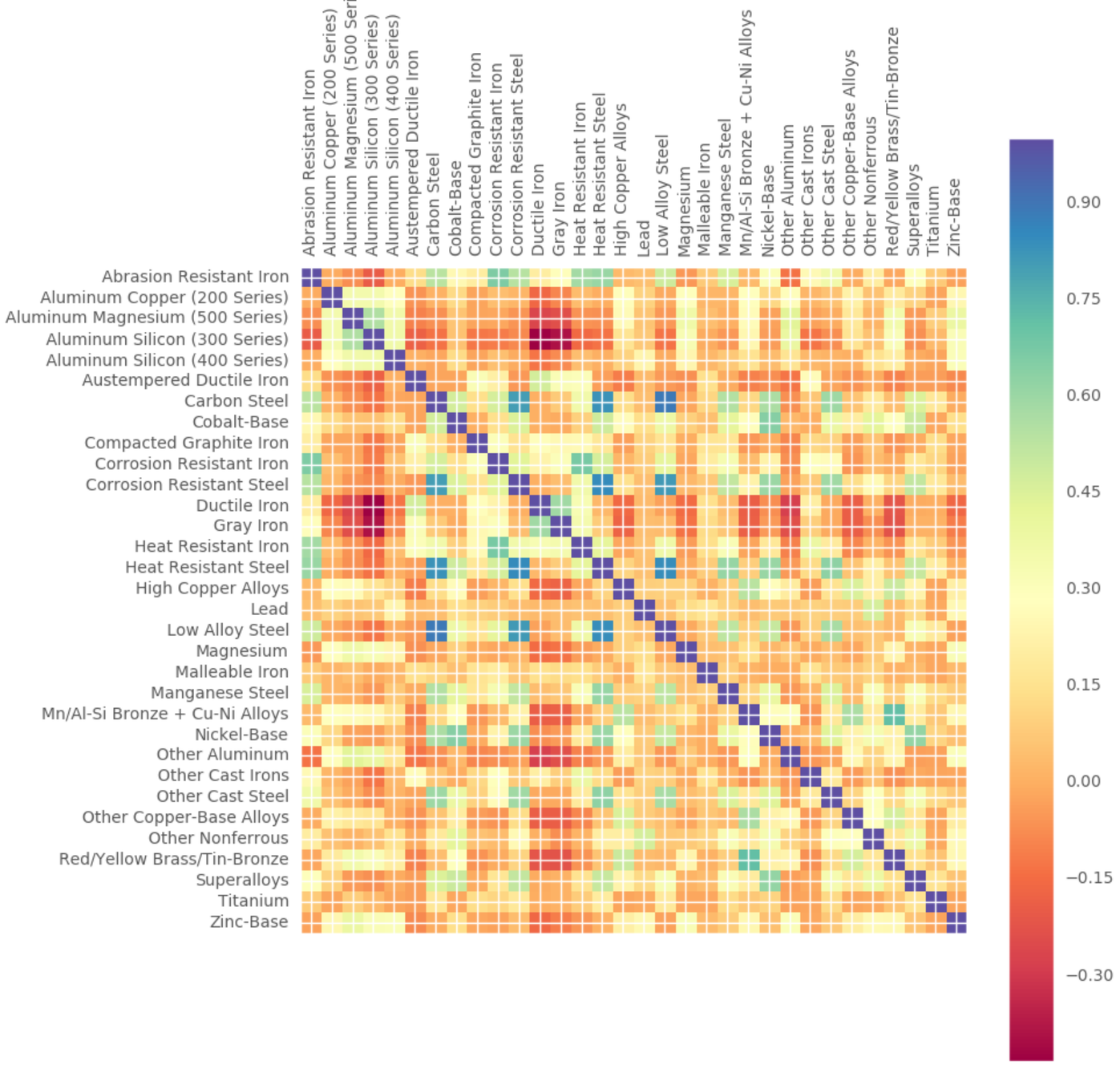
Process, Value Add Engineering, and Alloys: Insights

Little correlation between casting process and value add engineering

Some alloys are poured by a specific process.

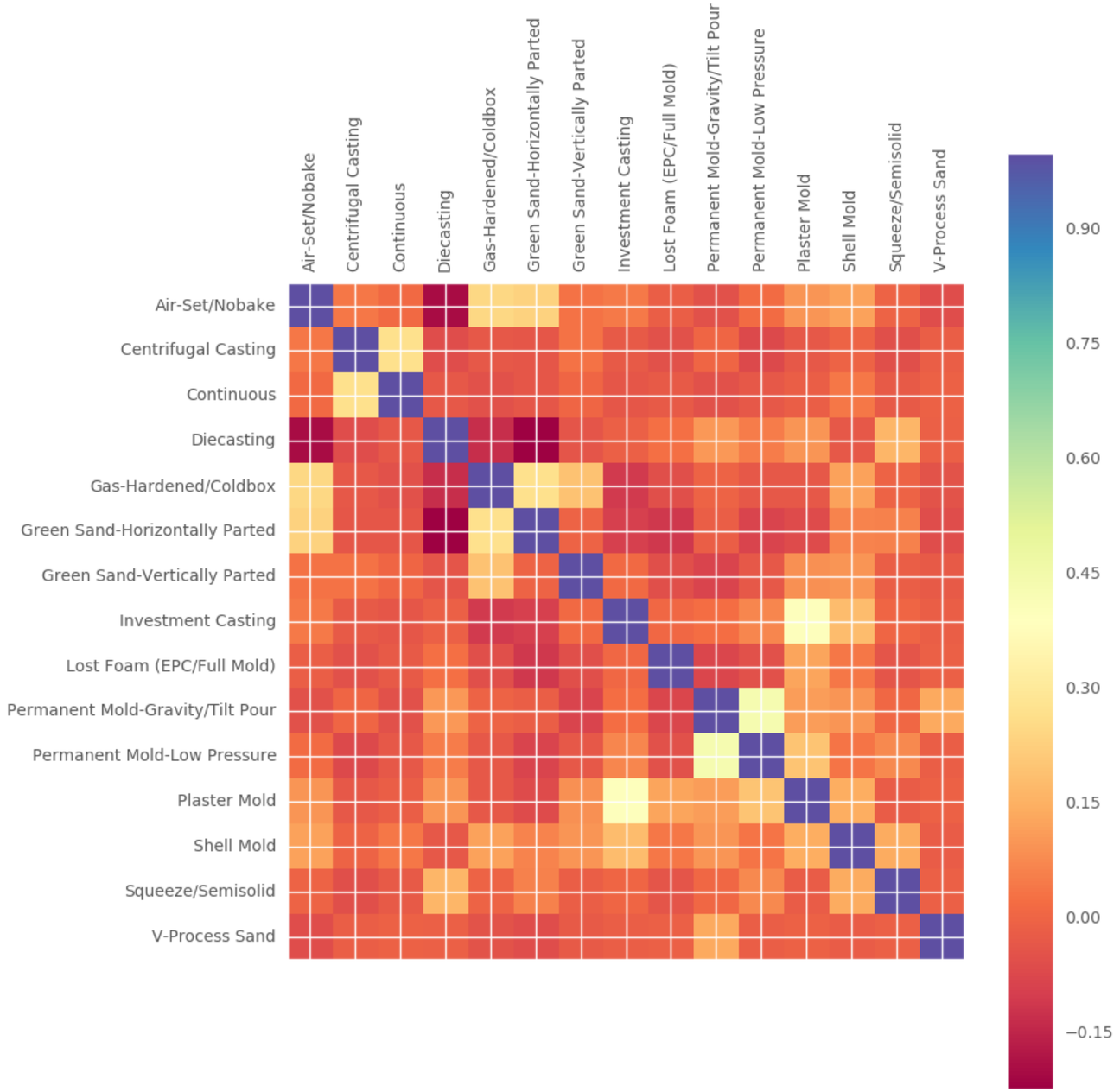
Value add engineering vs. alloy

Like vs. like



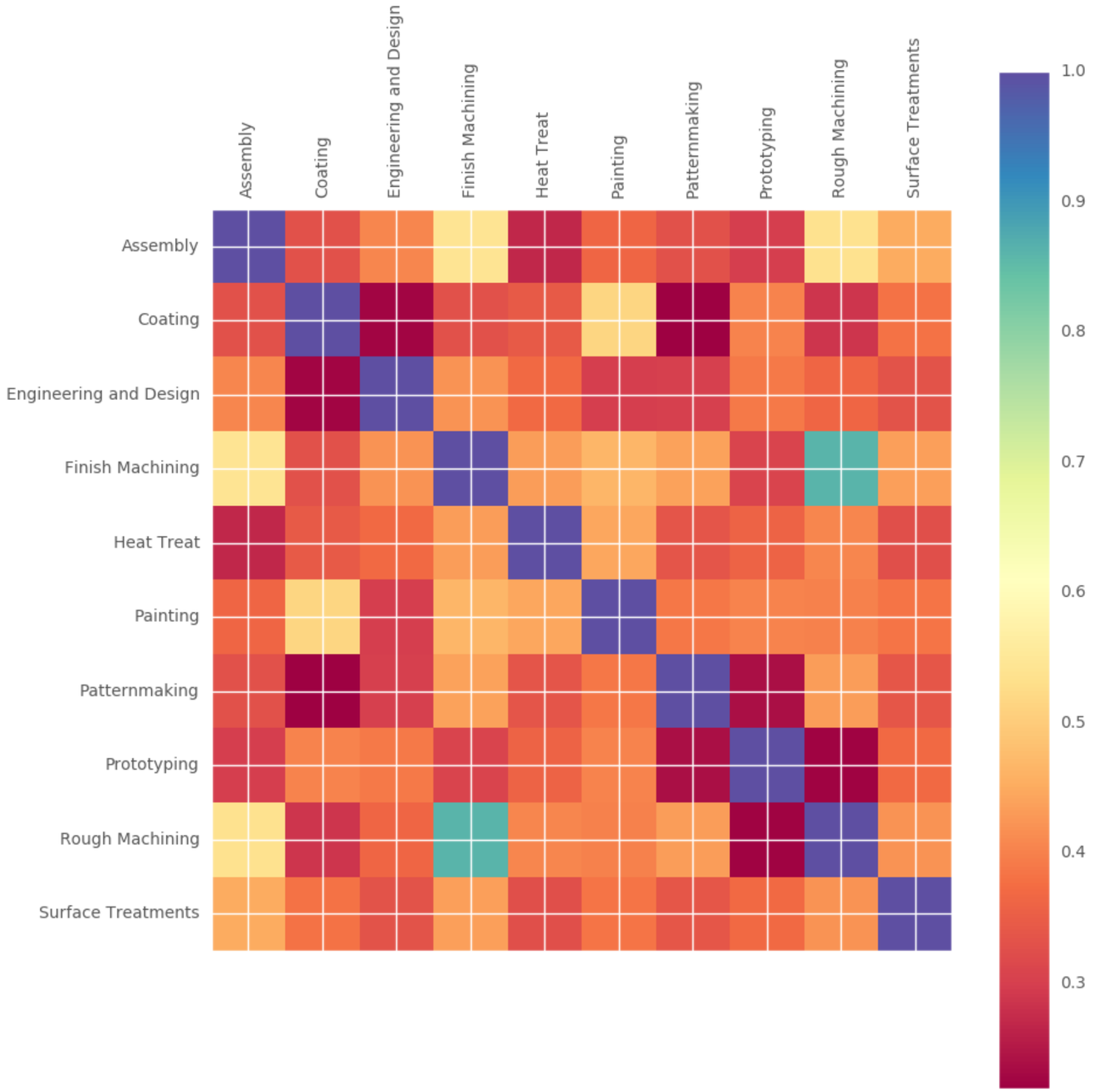
Alloys: Insights

- Ferrous (Iron-based) alloys typically offered together
- Aluminum alloys offered together
- Iron foundries appear to specialize



Casting Processes: Insights

- Diecasting and sand casting have a modest negative correlation.
- Investment casting variants are typically found together.



Value Add Processes: Insights

- Few strong relationships — many processes offered together
- If a foundry offers rough machining, they almost always offer finish machine too

Conclusions & Next Steps

Take Aways

- Not a great dataset for classification— logistic regression was noisy, dataset was small
- Some trends between processes and alloys
- Pronounced trends amongst alloys

Next Steps

- Source automotive, aerospace, labs-based turbine data
- Longitudinal data