

Business Performance Estimate

How To Start New Businesses Based On Customers' Reviews

Outline

- Introduction
- Data Source
- Workflow
- Result
- Conclusion & Future Work

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Why location is so important?

- Directly affect the source of actual audience
- Hard to estimate w/o actual practice and testing
- Time and money consuming
- Risky for new openings

Also, difficult to figure out **key attributes** strongly affecting the rating

What can *big data* do?

- Suggest a potential opening in designated area
- Estimate performance and rating based on the given location
- Find out the most significant factors combined with *machine learning*

Target Audience?

- Startup or individuals, the ones whom have little or no experience, willing to take less risks
- Corporate businesses companies, which want to expand their businesses

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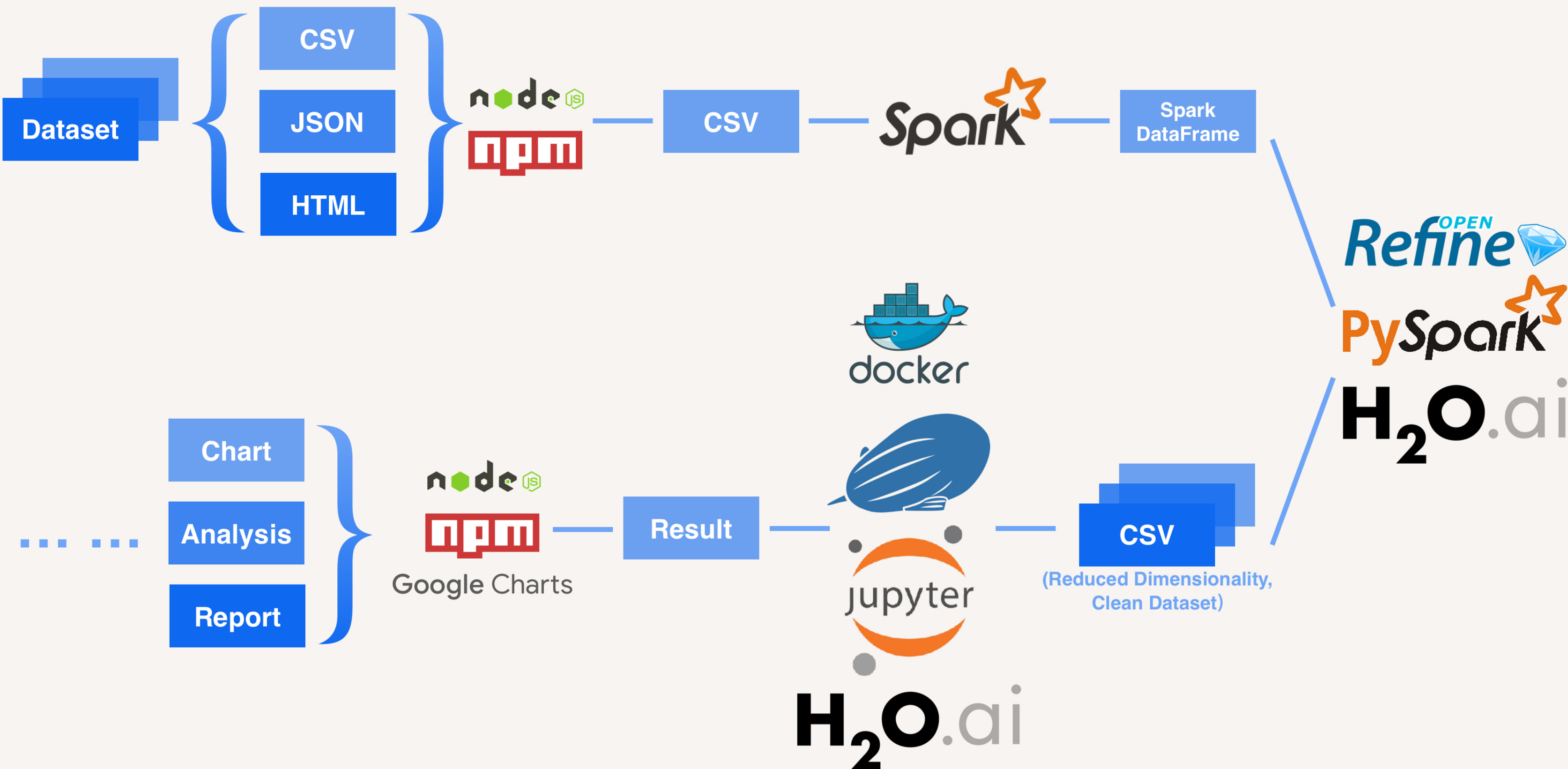
Data Source

- Yelp / FourSquare
 - 200k businesses
 - 5.2m ratings
- Financial statements from related corporate businesses
- data.gov: statistics of U.S. businesses

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Workflow



Workflow (Cont.)

- Formatter: convert .csv, .json and .html file into .csv
 - nodeJS & npm: json2csv package
 - Manually collect some useful info from the document
- Import .csv files into Spark:
 - Flatten attributes
 - Generate Spark DataFrames

Workflow (Cont.)

- Data Preprocessing:
 - Reduce dimensionality:
 - Feature selection & extraction
 - Principal Component Analysis (PCA)
 - Avoid overfitting
 - Clean data

Workflow (Cont.)

- Data Preprocessing:
 - Export into multiple .csv files:
 - Different categories
 - Different cities
 - etc.

Workflow (Cont.)

- Big Data Analysis:
 - Spark SQL module
 - H₂O Machine Learning
- Final Result:
 - Chart
 - Analysis

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Top 10 Categories For Each State

Chart

Category	Rating
Shaved Ice	4.408471787
Gelato	4.378077256
Coffee Roasteries	4.374378378
Cupcakes	4.345326146
Street Vendors	4.328106969
Poke	4.2968294
Local Services	4.22552278
Lebanese	4.224629437
Internet Cafes	4.19702228
Polish	4.19209245

Top 10 Cities For Chinese Restaurant

Chart

City	Rating
Aurora	3.782264274
Pickering	3.73193294
Newmarket	3.729253363
Stuttgart	3.592544663
Gilbert	3.560078808
Gastonia	3.559007997
Edinburgh	3.558972629
Huntersville	3.54797137
Fort Mill	3.47231295
Montreal	3.465306657

Compare Machine Learning Methods

- Chart (Group By Method)
- Chart (Group By Norm)

Method	MSE	RMSE	r^2	MAE	RMSLE
Random Forest	0.099864	0.316013	0.780328	0.230048	0.083253
Deep Learning	0.428654	0.654717	0.057082	0.503647	0.163133
Gradient Boosting	0.17661	0.42025	0.611507	0.282799	0.108599
XGBoost	0.408734	0.639323	0.100901	0.494821	0.159414

Find the Best Location For Opening¹

- Map

¹ Start a Chinese Restaurant within 100km of CMU

Latitude	Longitude
40.58086784	-79.96787628
40.45058945	-79.94779984
40.40169243	-79.98662125
40.50491615	-79.84231079
40.52941978	-79.82238525
40.58066582	-79.982173
40.43437424	-80.04482437
40.38809441	-80.00138367
40.40334869	-79.80644058
40.59245689	-80.03174149
40.5477742	-79.95699326
40.3231459	-79.73013123
40.44295708	-79.90212585
40.44473457	-79.98732758
40.54796066	-79.80494278
40.33876343	-79.84385193
40.50610336	-79.99850159
40.49517776	-80.00071564
40.43903557	-79.79106888
40.34159653	-79.74874847

Attributes

- Latitude comes first:
 - Location is really important

Attribute	Priority (%)
Latitude	0.0469
Accepts Credit Cards	0.0433
Price Range	0.0349
Good For Kids	0.0132
Good For Groups	0.012
Reservations	0.0108
Take Out	0.0108
Outdoor Seating	0.0096
Wi-Fi	0.0096
Noise Level	0.0084
Alcohol	0.0084

Estimate Rating Using Machine Learning Model

- Map

Latitude	Longitude	Name	Rating	Predicted Latitude	Predicted Longitude	Predicted Rating
40.6079763	-79.9480111	China One	5	40.58086784	-79.96787628	4.505034676
40.4577813	-79.9279191	Leaf and Plate	4.857142857	40.45058945	-79.94779984	3.763362393
40.3850883	-79.9784211	Bai Ling Chinese Restaurant	4.8	40.40169243	-79.98662125	2.82598614
40.541389	-79.785402	Hing Wong Chinese Restaurant	4.7	40.50491615	-79.84231079	4.193241377
40.5786182	-79.76802729	Bamboo Republic	4.684210526	40.52941978	-79.82238525	4.13273994
40.6079763	-79.9480111	Great China Buffet & Grill	4.666666667	40.58066582	-79.982173	4.375767517
40.4492001	-80.1413137	Golden Palace	4.6	40.43437424	-80.04482437	4.111687226
40.3684469	-80.0130696	China Village	4.6	40.38809441	-80.00138367	4.373784394
40.38963749	-79.76595686	Asian Cuisine	4.6	40.40334869	-79.80644058	4.077957993
40.6230346	-80.0532697	Lucky Chinese Restaurant	4.571428571	40.59245689	-80.03174149	4.155765901
40.5905329	-79.9483052	Golden Star	4.5	40.5477742	-79.95699326	3.781827807
40.3245138	-79.7011549	Golden Dragon Chinese Restaurant	4.5	40.3231459	-79.73013123	4.144460571
40.4601359	-79.8662771	Chopstick House	4.5	40.44295708	-79.90212585	2.739475996
40.4488823	-79.9873238	Little Shanghai	4.428571429	40.44473457	-79.98732758	3.222665143
40.5647219	-79.7646999	Panda Restaurant	4.363636364	40.54796066	-79.80494278	4.066682773
40.3383835	-79.8067112	Asian Garden	4.333333333	40.33876343	-79.84385193	3.47992743
40.55316272	-80.0155167	Ting's Kitchen	4.326923077	40.50610336	-79.99850159	3.403362675
40.5207492	-80.033128	Yeung's House	4.306122449	40.49517776	-80.00071564	2.916281404
40.4446763	-79.7136259	Golden Palace	4.290322581	40.43903557	-79.79106888	4.083773208
40.33327	-79.744246	China Garden	4.277777778	40.34159653	-79.74874847	3.631689882

Latitude	Longitude	Name	Rating	Predicted Latitude	Predicted Longitude	Predicted Rating	Diff
40.4341822	-79.9230114	Chopstix	1.333333333	40.44074471	-79.9340535	2.649065762	1.315732429
40.581774	-79.711476	China Lobster	1	40.57161385	-79.75000244	2.20973124	1.20973124
40.4434132	-79.9961509	Liang's Hunan Restaurant	1.428571429	40.43607285	-79.99523148	2.542267234	1.113695805
40.451222	-79.9515915	Kanda House	2.25	40.44327011	-79.9499939	3.136073895	0.886073895
40.2574515	-80.2041613	Panda Chinese Kitchen	2	40.27221344	-80.12045288	2.86918704	0.86918704
40.359115	-80.029173	Asian Garden	2.470588235	40.36658165	-79.99856583	3.315213966	0.844625731
40.441887	-80.07068	Panda	2.333333333	40.44397751	-80.03385208	3.106453898	0.773120565
40.444838	-79.9488538	Rose Tea Cafe	2.583333333	40.44042671	-79.94780975	3.343688784	0.760355451
40.2634203	-80.1738365	Wai Wai Buffet & Grill	2.0625	40.28242241	-80.12217941	2.817368279	0.754868279
40.3569591	-80.0518073	China Gate	2.588235294	40.37439728	-80.02707703	3.308677316	0.720442022
40.4610218	-79.922675	Yen's Gourmet	1.941176471	40.44954895	-79.9301088	2.600694215	0.659517744
40.4225729	-79.9285794	Yen's Gourmet	2	40.43402306	-79.93358459	2.649065762	0.649065762
40.4586356	-79.9174452	China Buffet	2	40.45010231	-79.92996109	2.631216443	0.631216443
40.4967498	-79.9436563	Hong Kong Taste	2.5	40.47657372	-79.95595795	3.127596874	0.627596874
40.4521842	-79.9516999	New China Inn	2	40.44658508	-79.94945404	2.622694216	0.622694216
40.4392206	-80.0017051	Mandarin Gourmet	3.02	40.43922058	-79.99263977	3.639661403	0.619661403
40.343451	-80.0268334	Golden Wok Inn	2.636363636	40.35520615	-80.02052185	3.2528145	0.616450864
40.4270707	-79.8905657	How Lee	2.5	40.43294128	-79.91048721	3.094122214	0.594122214
40.4306144	-80.0075896	Golden Palace Chinese Restaurant	2	40.43623764	-79.99405212	2.582274151	0.582274151
40.305713	-79.726267	Honey Moon Chinese Restaurant	2.333333333	40.32073143	-79.74686249	2.908988545	0.575655212

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Conclusion - Estimated Objectives

- For Individuals:
 - New businesses opening suggestions
 - Given category / area
- For Corporate Businesses:
 - Where to expand
 - How to improve ratings

Conclusion - Estimated Objectives

- For Both:
 - Key attributes affecting on ratings

Future Work

- If given more data:
 - Time lapse: trends
 - More city data
- Rating vs. Profit
 - Long-term eyesight

Q&A

Thank you!