Data Science in Action

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Data Scientist

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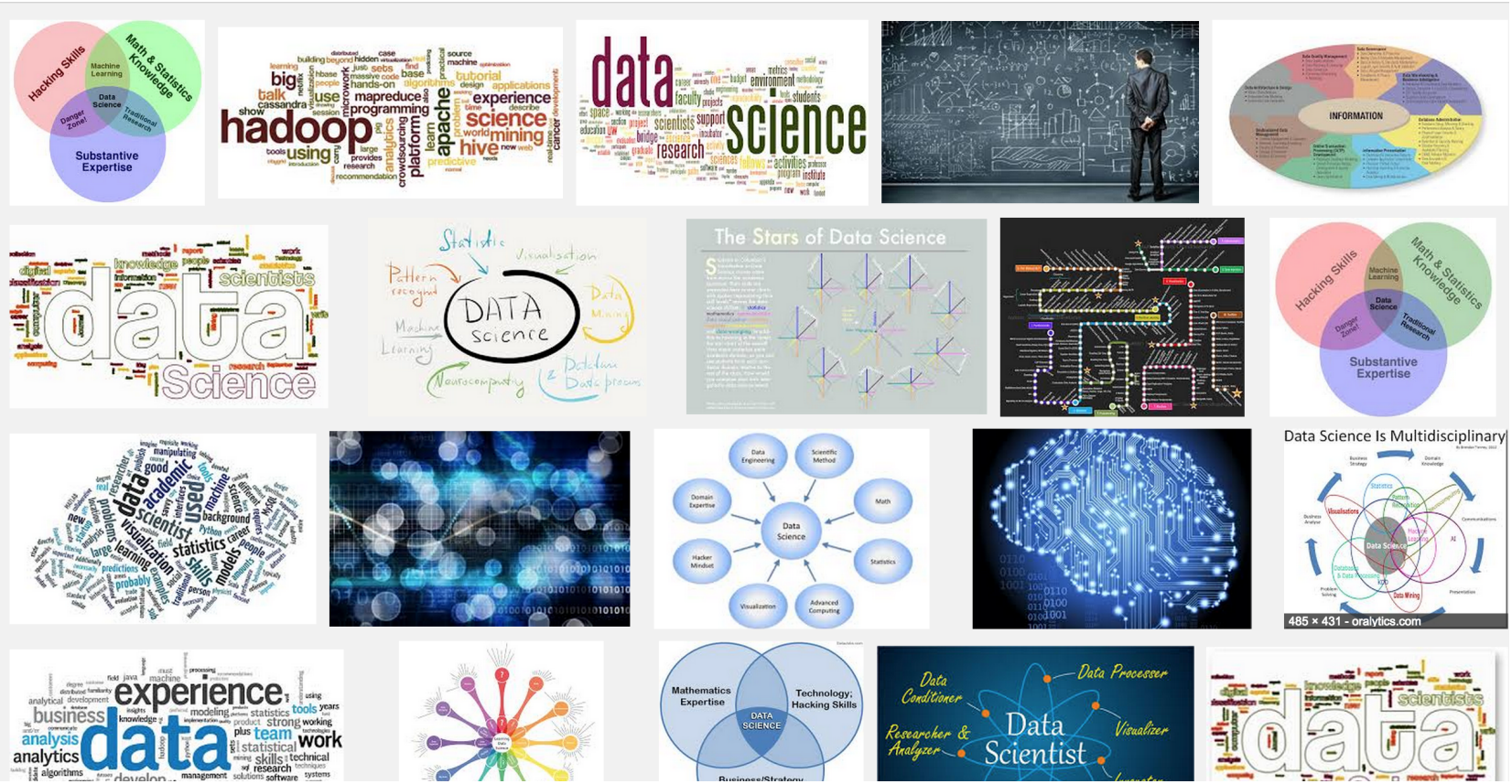
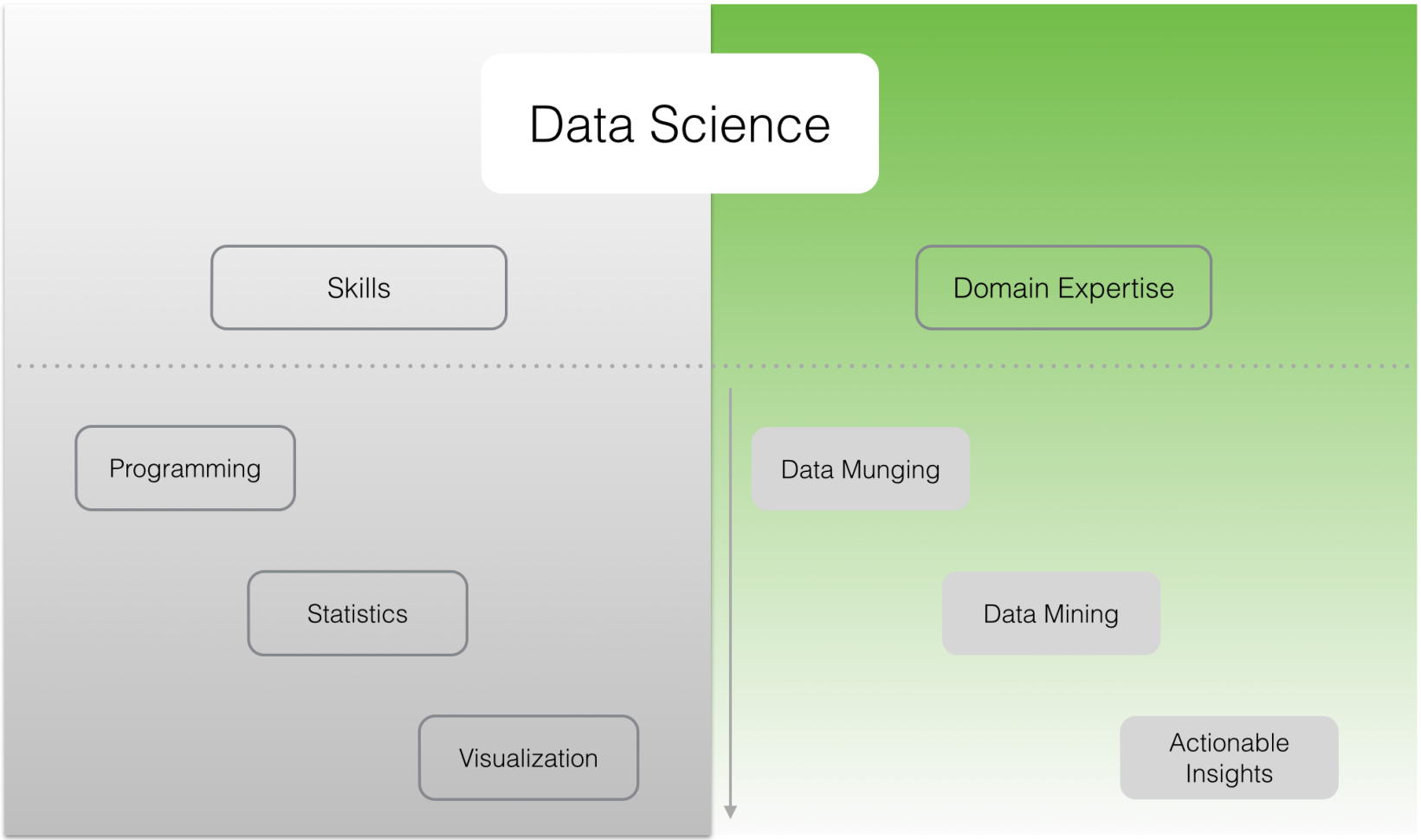
Data science on Google search



Data science from my point of view



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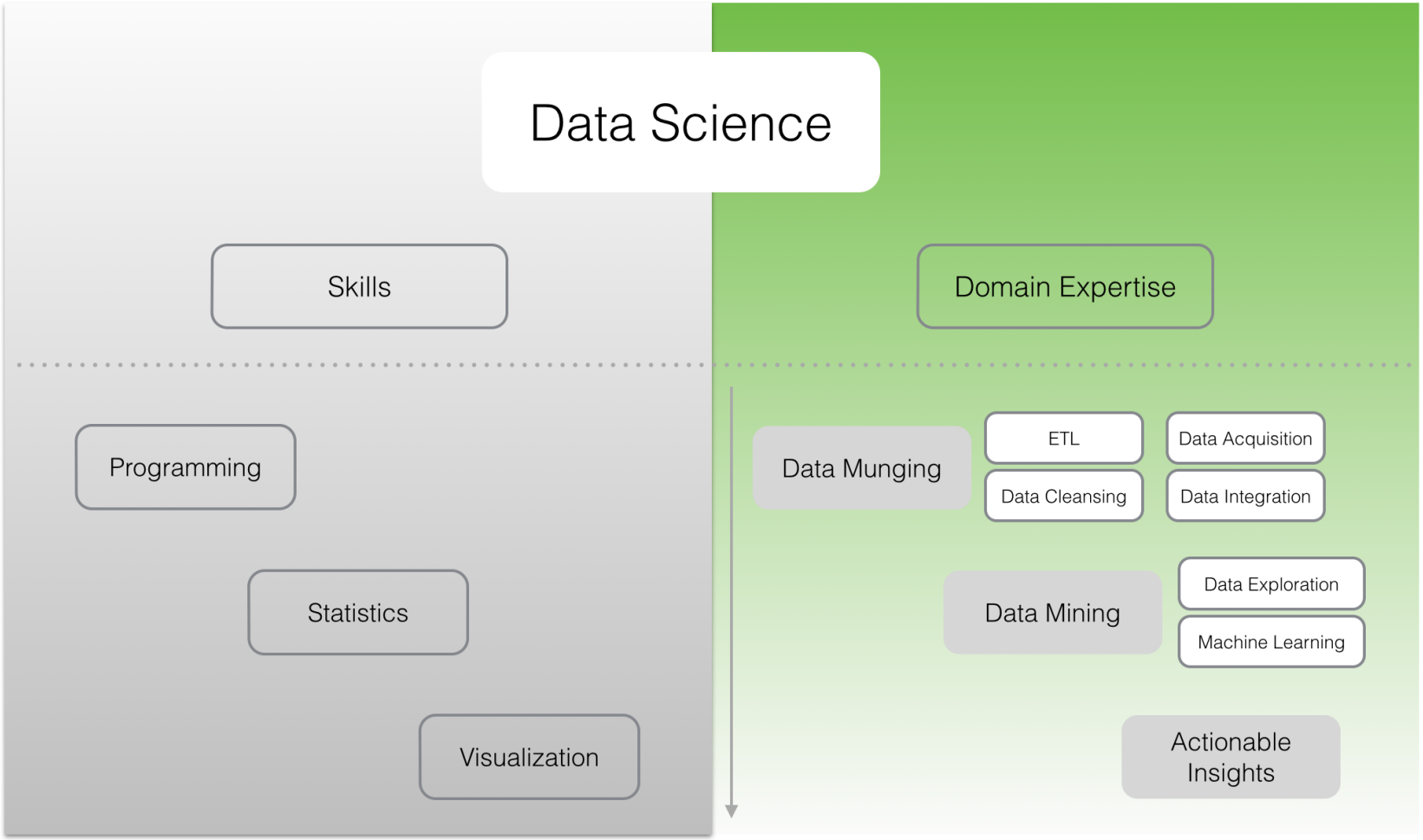
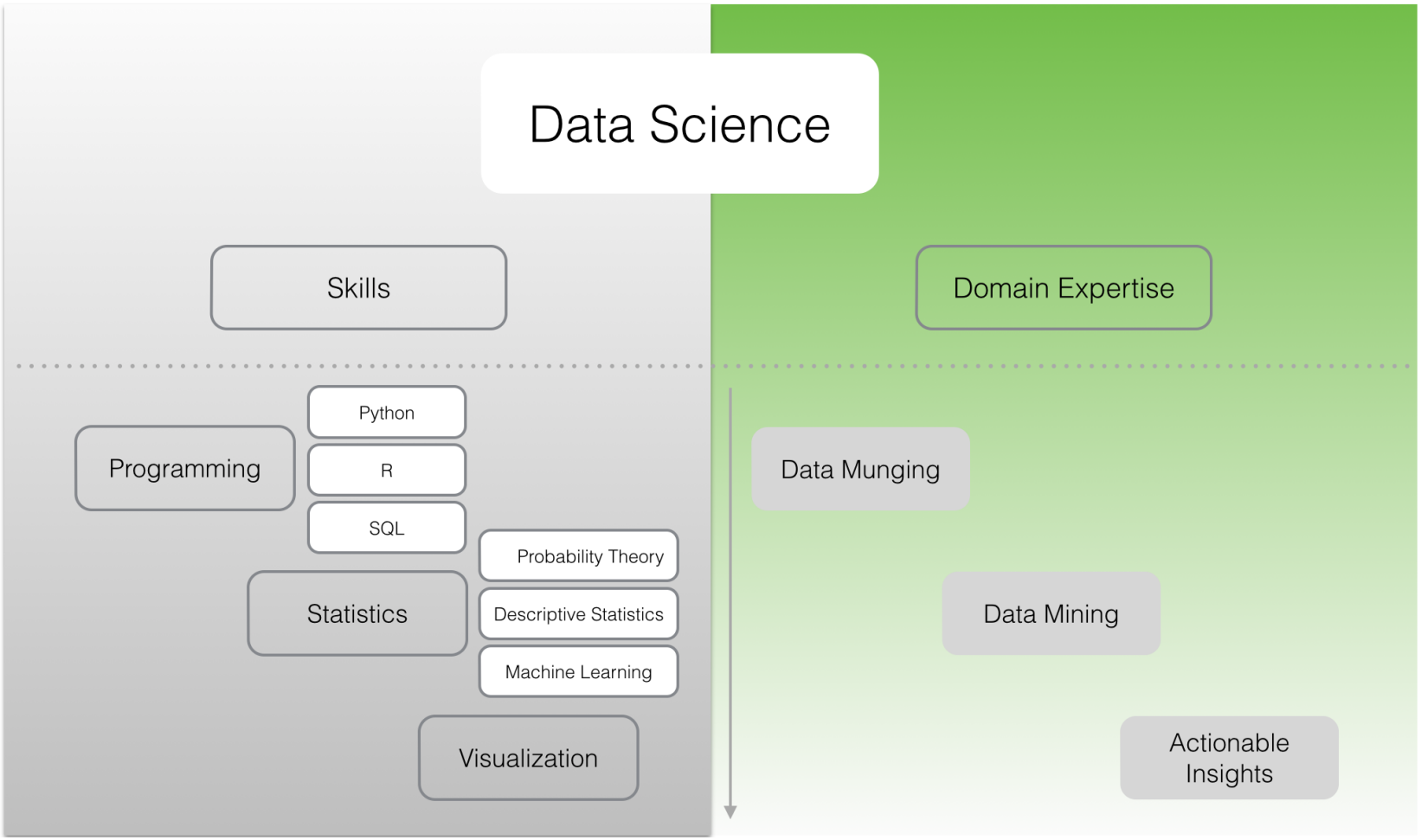
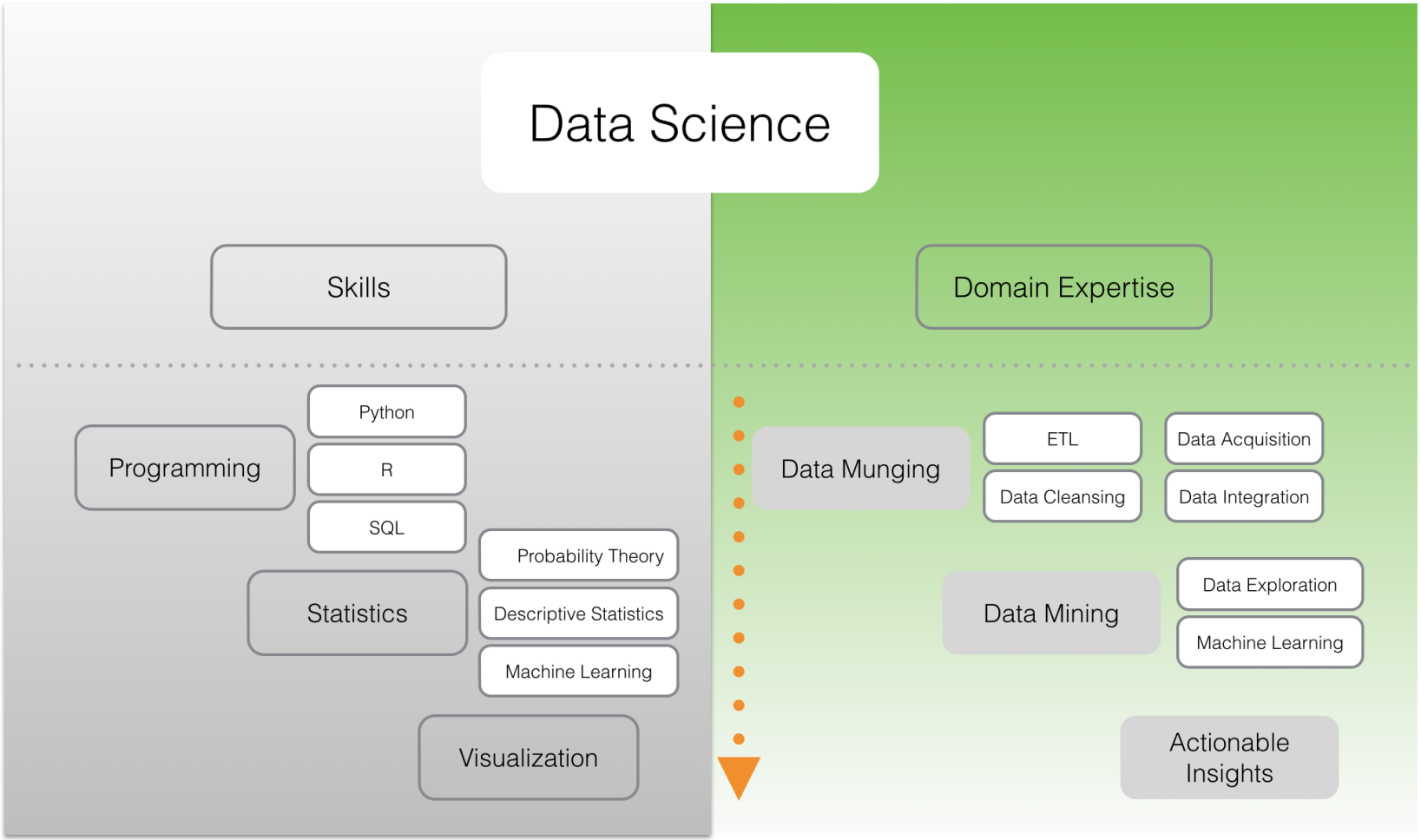
Domain expertise of a data scientist



Skills of a data scientist



Doing data science



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The quest

Definition of a churned customer

Goal

- To predict which customers will churn.

Data sets

- Customer renew data.
- Customer support data.
- Customer account and demographic data.
- Customer usage data.

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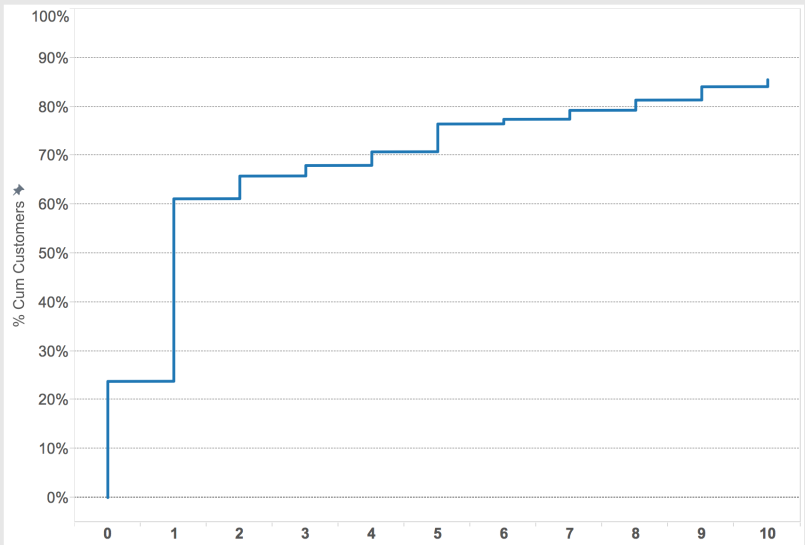
Customer renewal data

Raw data

customer_id	is_churn	days_renew
1	False.	0
2	False.	0
3	False.	0
4	False.	0
5	False.	0
6	False.	0
7	False.	0
8	False.	0
9	False.	0
10	False.	0
12	False.	0
13	False.	0

Renewal Schedule

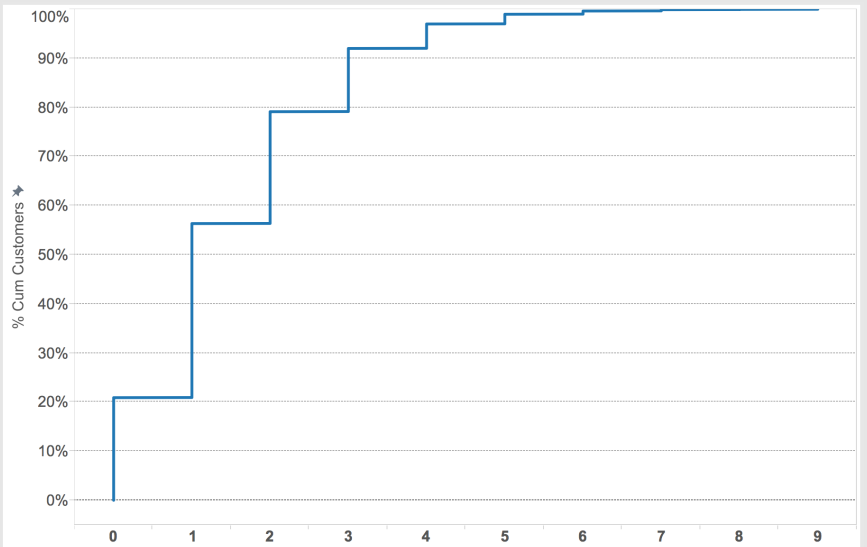


Customer service call data

Raw data

customer_id	cust_surv_calls
1	1
2	1
3	0
4	2
5	3
6	0
7	3
8	0
9	1

Cumulative distribution



Customer plan type and demographic

customer_id	state	account_len	area_code	phone	is_intl_plan	is_vmail_plan
1	KS	128	415	382-4657	no	yes
2	OH	107	415	371-7191	no	yes
3	NJ	137	415	358-1921	no	no
4	OH	84	408	375-9999	yes	no
5	OK	75	415	330-6626	yes	no
6	AL	118	510	391-8027	yes	no
7	MA	121	510	355-9993	no	yes
8	MO	147	415	329-9001	yes	no
9	LA	117	408	335-4719	no	no

Customer usage data

customer_id	vmail_messages	day_mins	day_calls	day_charge	eve_mins	eve_calls	eve_charge	night_mins	night_calls	night_charge	intl_mins	intl_calls	intl_charge
1	25	265.1	110	45.07	197.4	99	16.78	244.7	91	11.01	10	3	2.7
2	26	161.6	123	27.47	195.5	103	16.62	254.4	103	11.45	13.7	3	3.7
3	0	243.4	114	41.38	121.2	110	10.3	162.6	104	7.32	12.2	5	3.29
4	0	299.4	71	50.9	61.9	88	5.26	196.9	89	8.86	6.6	7	1.78
5	0	166.7	113	28.34	148.3	122	12.61	186.9	121	8.41	10.1	3	2.73
6	0	223.4	98	37.98	220.6	101	18.75	203.9	118	9.18	6.3	6	1.7
7	24	218.2	88	37.09	348.5	108	29.62	212.6	118	9.57	7.5	7	2.03
8	0	157	79	26.69	103.1	94	8.76	211.8	96	9.53	7.1	6	1.92
9	0	184.5	97	31.37	351.6	80	29.89	215.8	90	9.71	8.7	4	2.35
10	37	258.6	84	43.96	222	111	18.87	326.4	97	14.69	11.2	5	3.02
12	0	187.7	127	31.91	163.4	148	13.89	196	94	8.82	9.1	5	2.46
13	0	128.8	96	21.9	104.9	71	8.92	141.1	128	6.35	11.2	2	3.02
14	0	156.6	88	26.62	247.6	75	21.05	192.3	115	8.65	12.3	5	3.32
15	0	120.7	70	20.52	307.2	76	26.11	203	99	9.14	13.1	6	3.54
17	27	196.4	139	33.39	280.9	90	23.88	89.3	75	4.02	13.8	4	3.73
18	0	190.7	114	32.42	218.2	111	18.55	129.6	121	5.83	8.1	3	2.19
19	33	189.7	66	32.25	212.8	65	18.09	165.7	108	7.46	10	5	2.7
20	0	224.4	90	38.15	159.5	88	13.56	192.8	74	8.68	13	2	3.51
21	0	155.1	117	26.37	239.7	93	20.37	208.8	133	9.4	10.6	4	2.86

Churn data structure

```
$ customer_id    : int  1 2 3 4 5 6 7 8 9 10 ...
$ state          : Factor w/ 51 levels "AK","AL","AR",..: 17 36 32 36 37 2 20 25 19 50 ...
$ account_len    : int  128 107 137 84 75 118 121 147 117 141 ...
$ area_code      : int  415 415 415 408 415 510 510 415 408 415 ...
$ phone          : Factor w/ 3333 levels "327-1058","327-1319",..: 1927 1576 1118 1708 111 2254 1048 81
$ is_intl_plan   : Factor w/ 2 levels "no","yes": 1 1 1 2 2 2 1 2 1 2 ...
$ is_vmail_plan  : Factor w/ 2 levels "no","yes": 2 2 1 1 1 1 2 1 1 2 ...
$ vmail_messages : int  25 26 0 0 0 0 24 0 0 37 ...
$ day_mins       : num  265 162 243 299 167 ...
$ day_calls      : int  110 123 114 71 113 98 88 79 97 84 ...
$ day_charge     : num  45.1 27.5 41.4 50.9 28.3 ...
$ eve_mins       : num  197.4 195.5 121.2 61.9 148.3 ...
$ eve_calls      : int  99 103 110 88 122 101 108 94 80 111 ...
$ eve_charge     : num  16.78 16.62 10.3 5.26 12.61 ...
$ night_mins     : num  245 254 163 197 187 ...
$ night_calls    : int  91 103 104 89 121 118 118 96 90 97 ...
$ night_charge   : num  11.01 11.45 7.32 8.86 8.41 ...
$ intl_mins      : num  10 13.7 12.2 6.6 10.1 6.3 7.5 7.1 8.7 11.2 ...
$ intl_calls     : int  3 3 5 7 3 6 7 6 4 5 ...
$ intl_charge    : num  2.7 3.7 3.29 1.78 2.73 1.7 2.03 1.92 2.35 3.02 ...
$ cust_surv_calls: int  1 1 0 2 3 0 3 0 1 0 ...
$ is_churn       : Factor w/ 2 levels "False.","True.": 1 1 1 1 1 1 1 1 1 1 ...
$ days_renew     : int  0 0 0 0 0 0 0 0 0 0 ...
```

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R Script

https://github.com/vieplivee/Data-Science-in-Action/blob/master/src/churn.R

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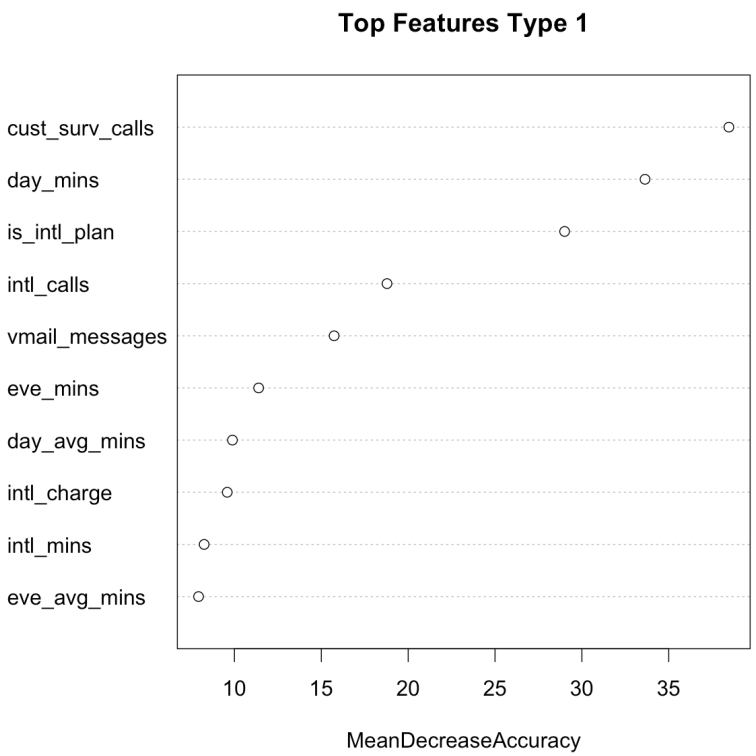
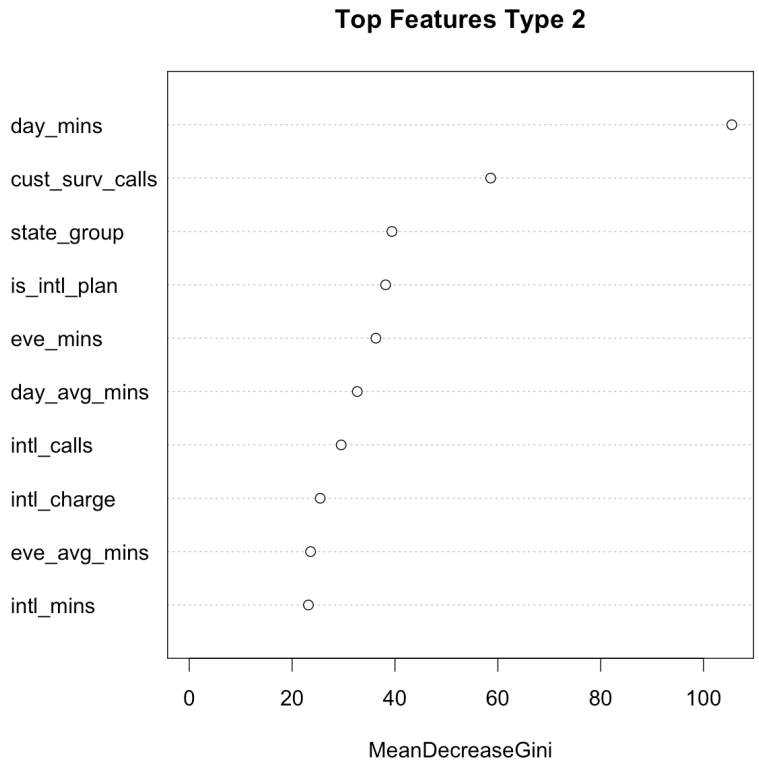
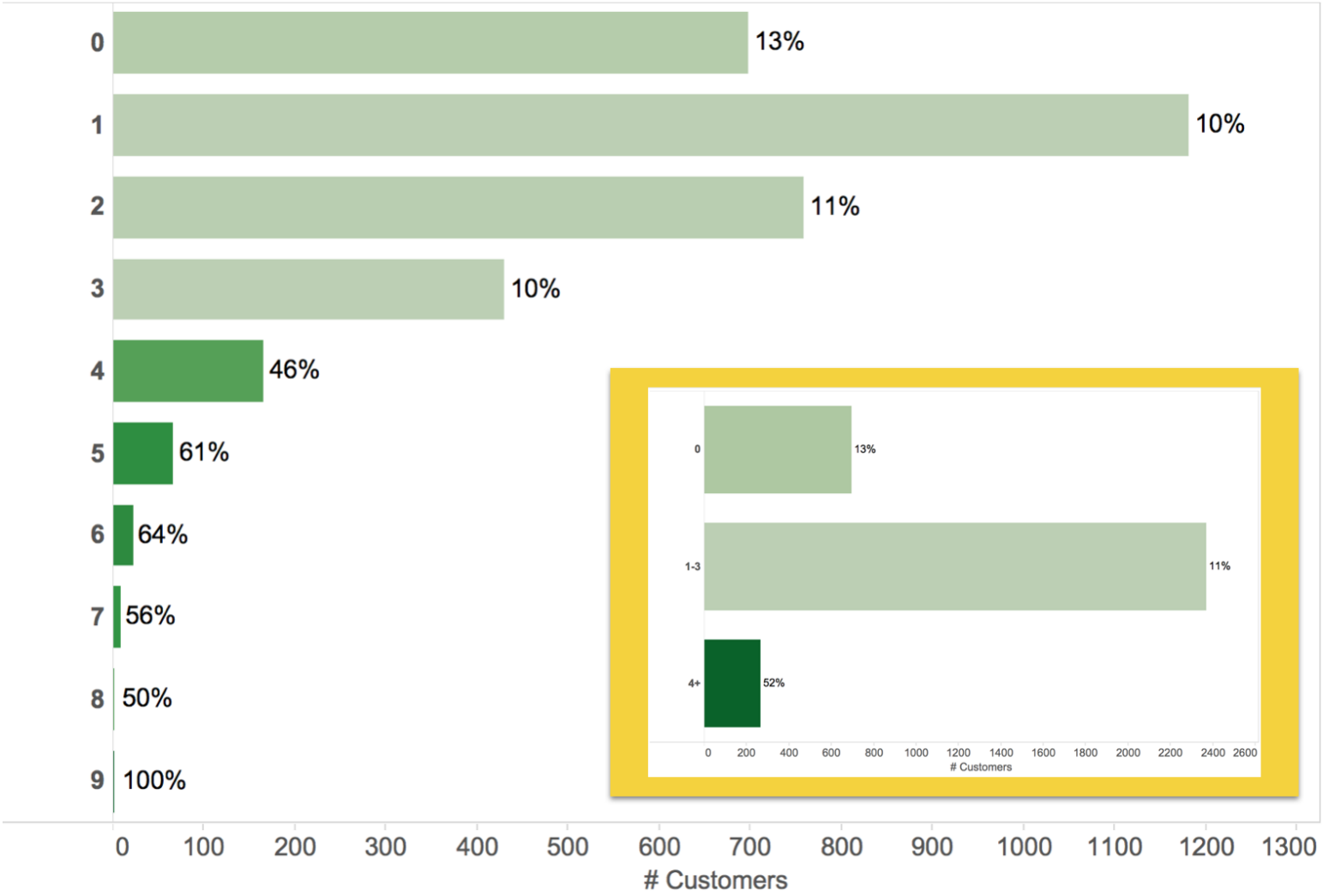
Variable importance from random forest





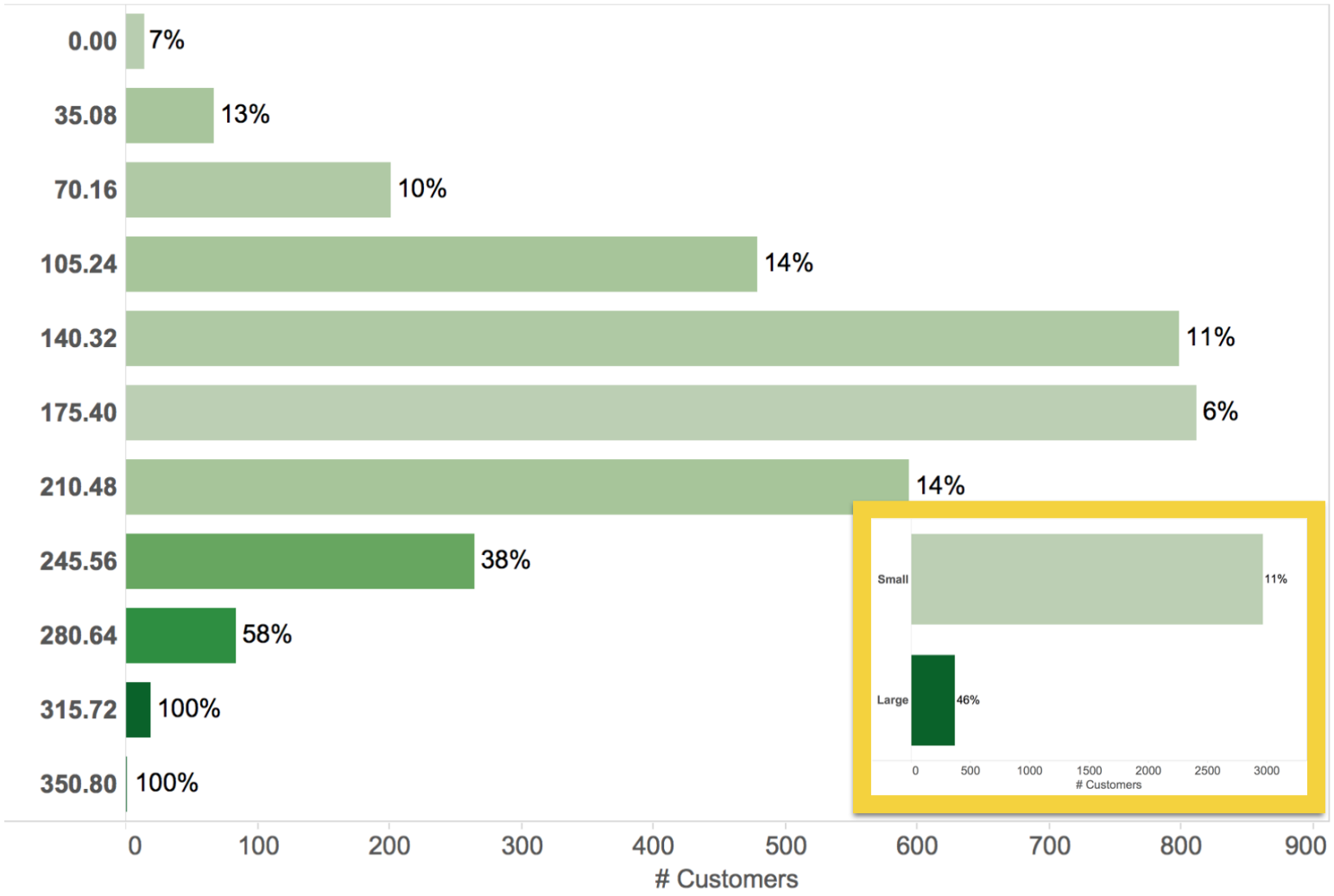
Churn Model: Top Features

Top feature - customer service calls



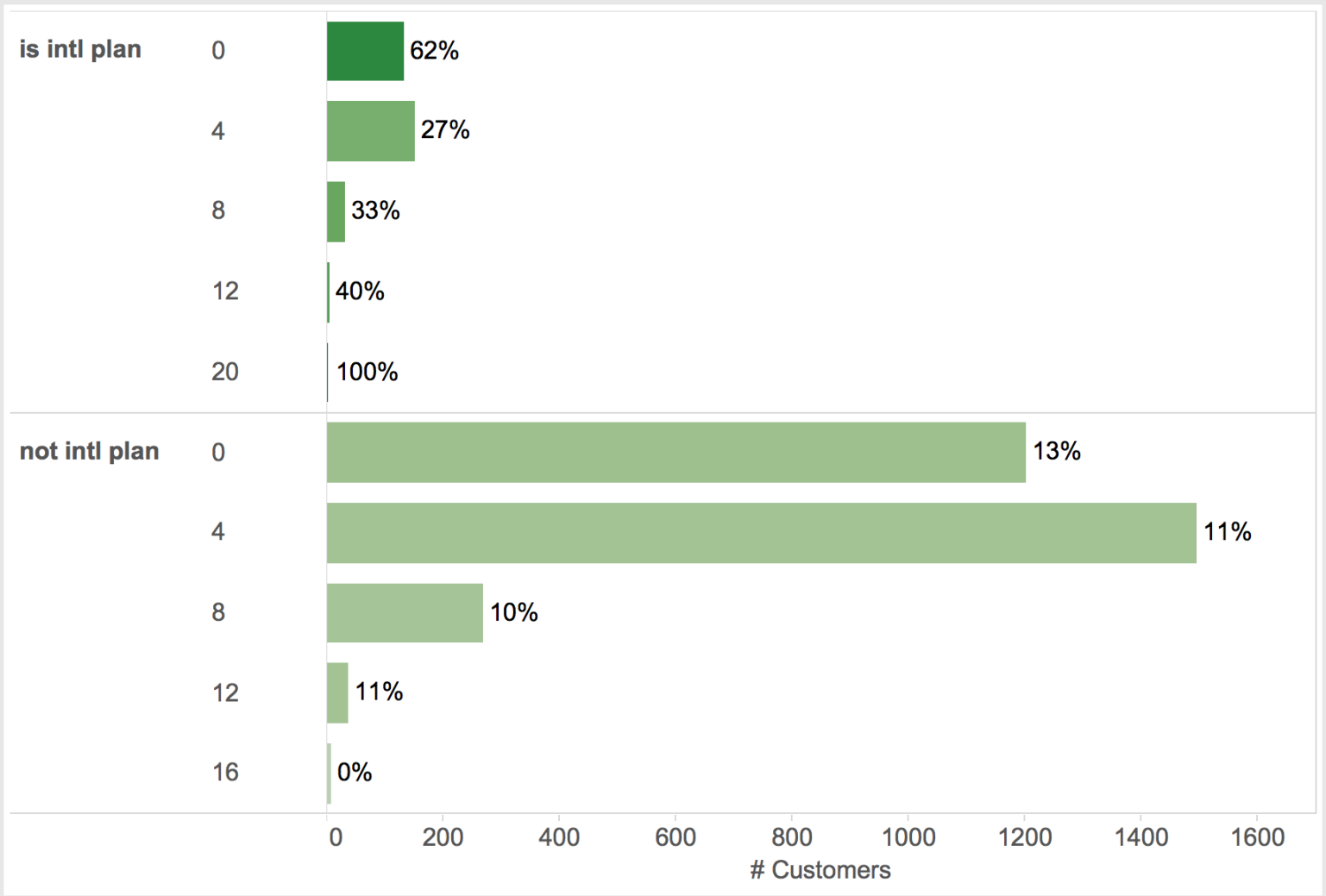
Churn Model: Top Features

Top feature - customer day time minutes



Churn Model: Top Features

Top feature - international plan and international calls



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Churn analysis

Is Intl Plan	Cust Surv Calls (group)	Day Mins Group	% Churn	Number of Records	Summary
is intl plan	0	Large	60%	15	Small Group
		Small	44%	68	Small Group
	1-3	Large	56%	36	Small Group
		Small	34%	176	
	4+	Large	100%	1	Outlier
		Small	67%	27	Small Group
not intl plan	0	Large	48%	60	Small Group
		Small	4%	554	Low Churn
	1-3	Large	43%	229	
		Small	4%	1,928	Low Churn
	4+	Large	44%	27	Small Group
		Small	50%	212	
Grand Total			**14%**	**3,333**	

Churn analysis

Is Intl Plan	Cust Surv Calls (group)	Day Mins Group	% Churn	# Customers	Summary	Avg Charge	Revenue if we got 10% of the churned customers back
is intl plan	0	Large	60%	15	Small Group	$ 72	$ 65
		Small	44%	68	Small Group	$ 56	$ 168
	1-3	Large	56%	36	Small Group	$ 72	$ 144
		Small	34%	176		$ 55	$ 325
	4+	Large	100%	1	Outlier	$ 78	$ 8
		Small	67%	27	Small Group	$ 56	$ 101
not intl plan	0	Large	48%	60	Small Group	$ 73	$ 212
		Small	4%	554	Low Churn	$ 55	$ 132
	1-3	Large	43%	229		$ 72	$ 706
		Small	4%	1,928	Low Churn	$ 55	$ 418
	4+	Large	44%	27	Small Group	$ 74	$ 89
		Small	50%	212		$ 54	$ 578
Grand Total			**14%**	**3,333**		$ 57	$ 2,660

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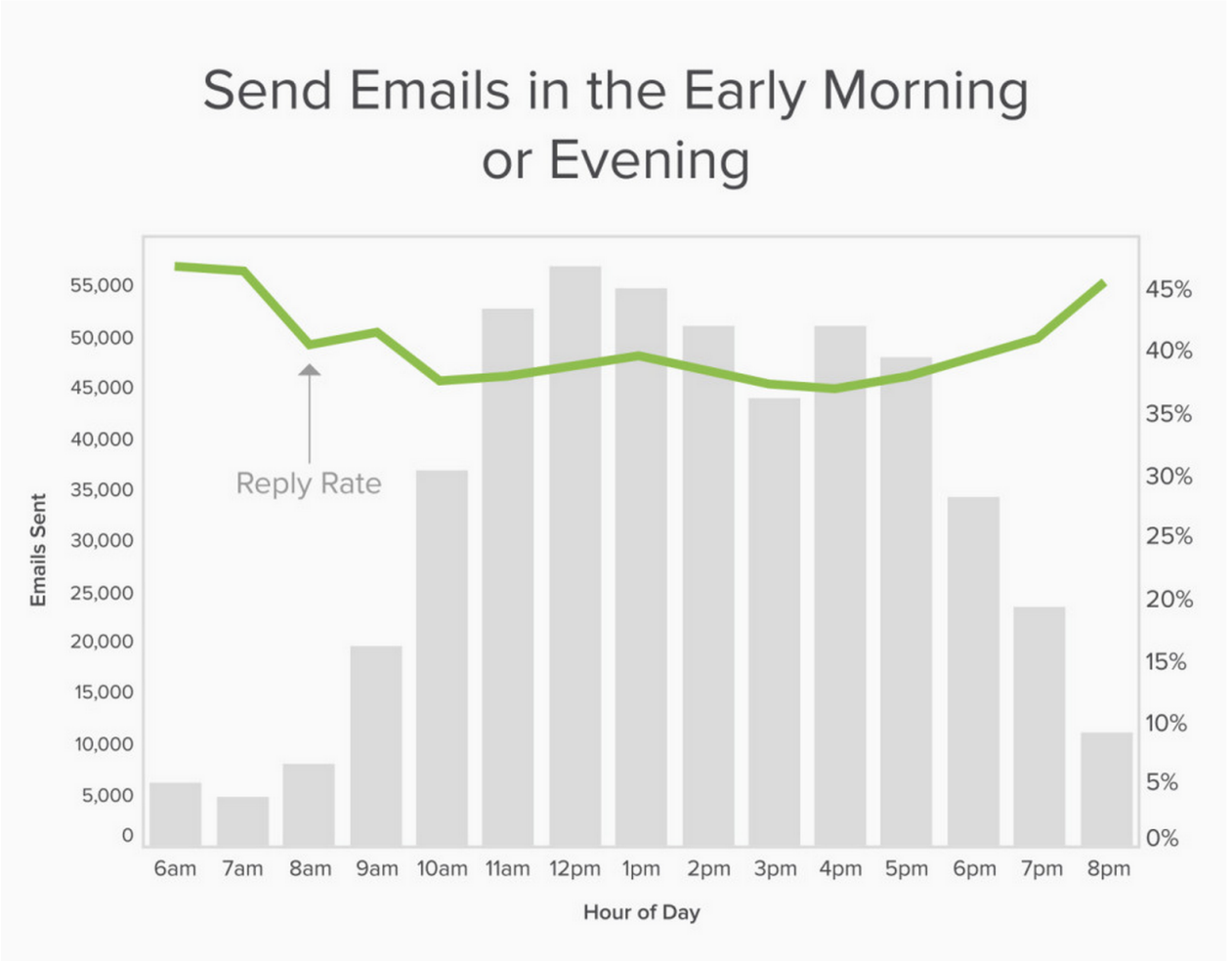
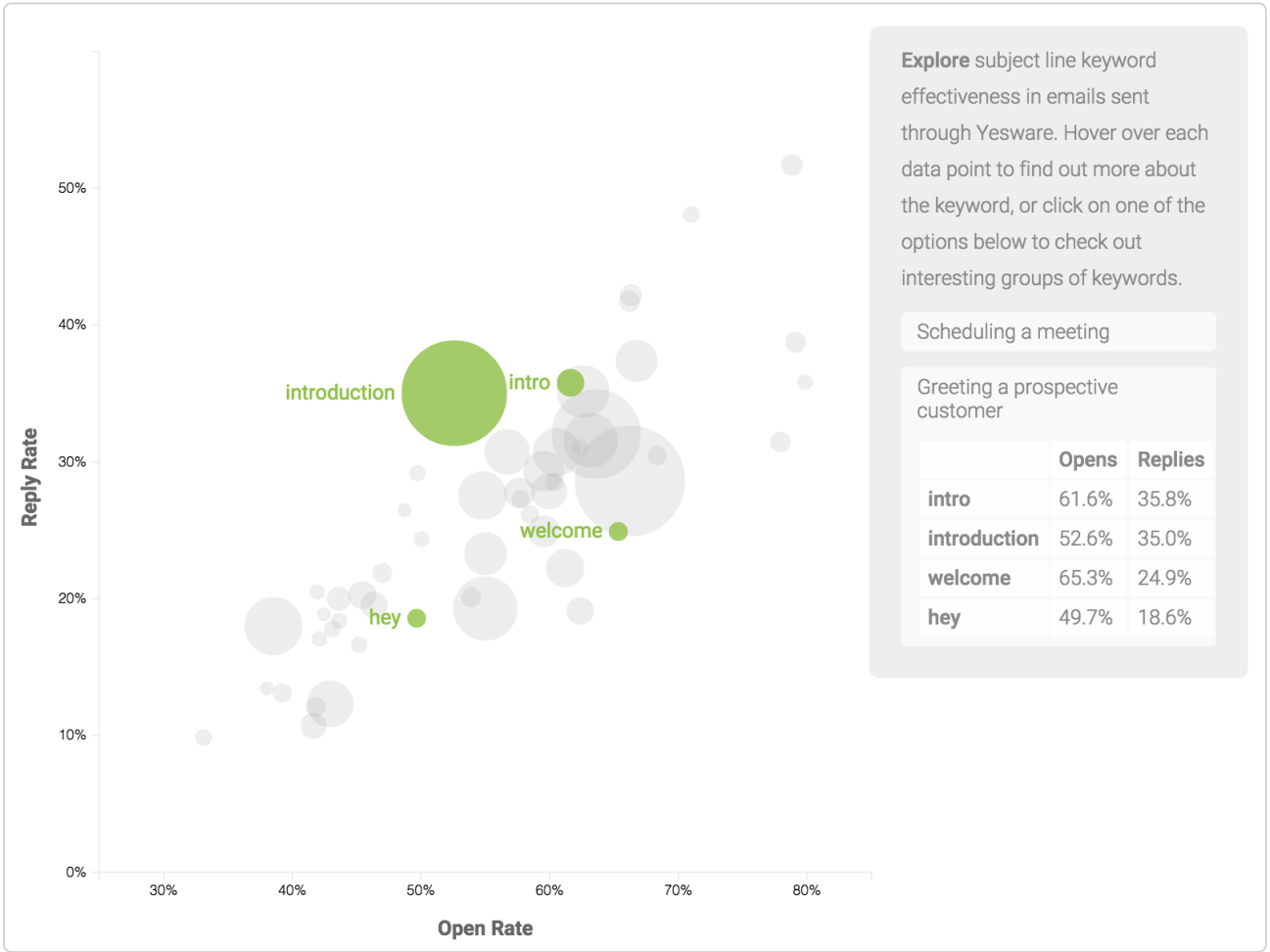
When to send an email



Best time to send email: `http://goo.gl/lVdD31`

D3 Visualization: Subject Line Analysis



Subject line key words: `http://goo.gl/PK9xh0`

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From academia to industry

	Academia	Industry
Goal	Improve human knowledge	Make money
Success Criteria	Publish papers	Create and deliver business value
Approach	Finding a better way to do a hard thing	Finding the fastest way to do easy things
Importance of Speed	**Not as important as other things**	**Very important**

Why do we need a toolbox?

	Academia	Industry
Goal	Improve human knowledge	Make money
Success Criteria	Publish papers	Create and deliver business value
Approach	Finding a better way to do a hard thing	Finding the fastest way to do easy things
Importance of Speed	**Not as important as other things**	**Very important**

Python and R for data science

	Python	R
Powerful Packages	Numpy, Scipy, Pandas Scikit-Learn	caret, rROC, ggplot2, dplyr, reshape2
Community Support	fast growing	strongest support from the statistics community
Data Munging	****	***
Data Exploration	****	*****
Machine Learning	****	*****
Programming Interface	iPython	RStudio

iPython `http://goo.gl/zT4uPE` — RStudio `http://www.rstudio.com/`

Data manipulation tools

	Python	R	Unix	SQL	Scala
Powerful Packages / Library	★★★★★	★★★★★	★★	★	★★★★
Community Support	★★★★★	★★★★★	★★★★	★★★	★★★★
Data Munging	★★★★	★★★	★★★★	★★★★	★★★★
Data Exploration	★★★★	★★★★★	★★	★★★	★★★
Machine Learning	★★★★	★★★★★	★	★★	★★★★

Data visualization tools

	Excel	R	Tableau	D3
Ease of Learning	★★★★★	★★★	★★★★★	★
Is Free	No	Yes	No	Yes
Good for Data Exploration	★★	★★★★	★★★★★	★★★
Flexibility in Data Representation	★★	★★★★	★★★★	★★★★★
Good for Reporting and Sharing	★★★★	★★★★	★★★	★★★★

D3 `http://d3js.org/`

Thank You

Please send your questions and feedbacks to me!