DATA SCIENCE

with

SMALL TEAMS

Drew Fustin

PhD, Physics

Lead Data Scientist

SPOT HERO

drewfustin@gmail.com | 7.5.2016 | PyData Chicago

DATA SCIENCE

with

SMALL TEAMS

Or: Lots of Advice I Need to Hear and Apply Myself

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DATA SCIENCE

according to Jeremy Stanley, VP of Data Science at Instacart

DECISION SCIENCE

use data to analyze business metrics — such as growth, engagement, profitability drivers, and user feedback — to inform strategy and key business decisions.

DATA PRODUCTS

use data and engineering to improve product performance, typically in the form of better search results, recommendations, and automated decisions.

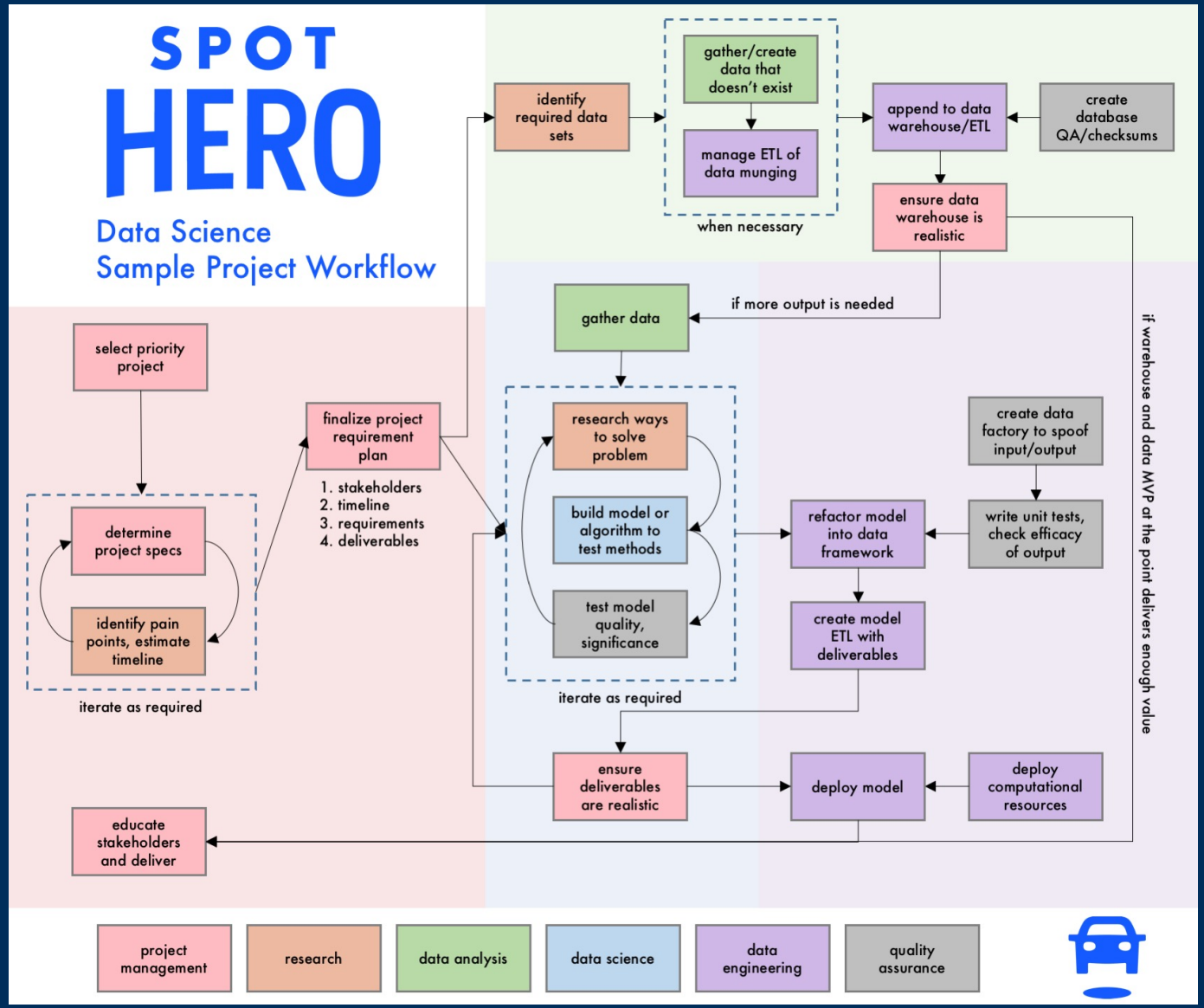
DATA SCIENCE

according to Jeremy Stanley, VP of Data Science at Instacart

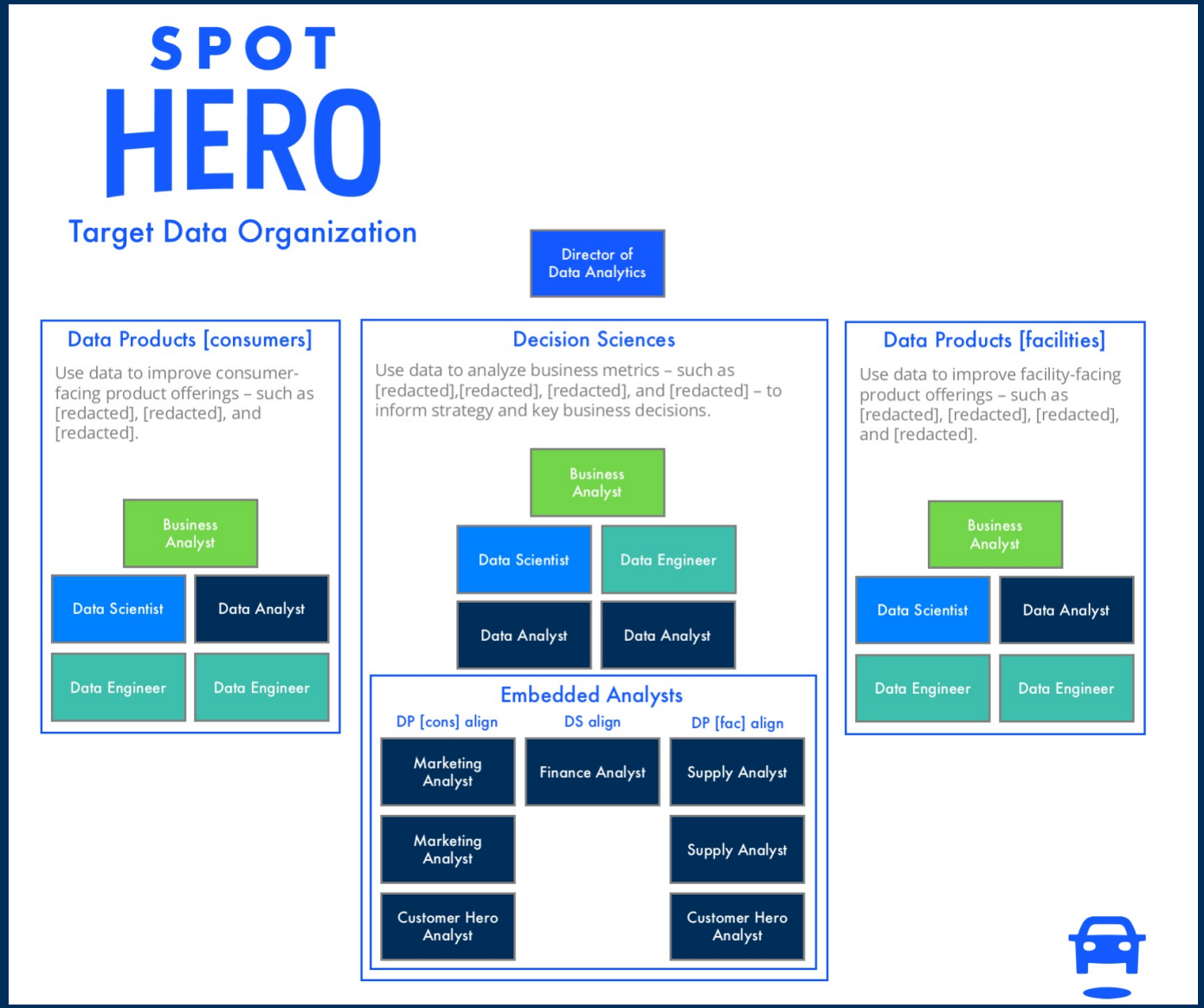
"While decision science and data products call for some of the same skills, it's rare for data scientists to excel at both. Decision science depends on business and product sense, systems thinking, and strong communication skills. Data products require machine learning knowledge and production-level engineering skills. If you have a small data science team, you may need to find the rare superstars who can do both. But you'll benefit from specialization as you scale your team."

Doing Data Science Right — Your Most Common Questions Answered
Jeremy Stanley and Daniel Tunkelang
http://firstround.com/review/doing-data-science-right-your-most-common-questions-answered/

DATA SCIENCE IS COMPLICATED



DATA SCIENCE IS EASIEST WITH A TEAM



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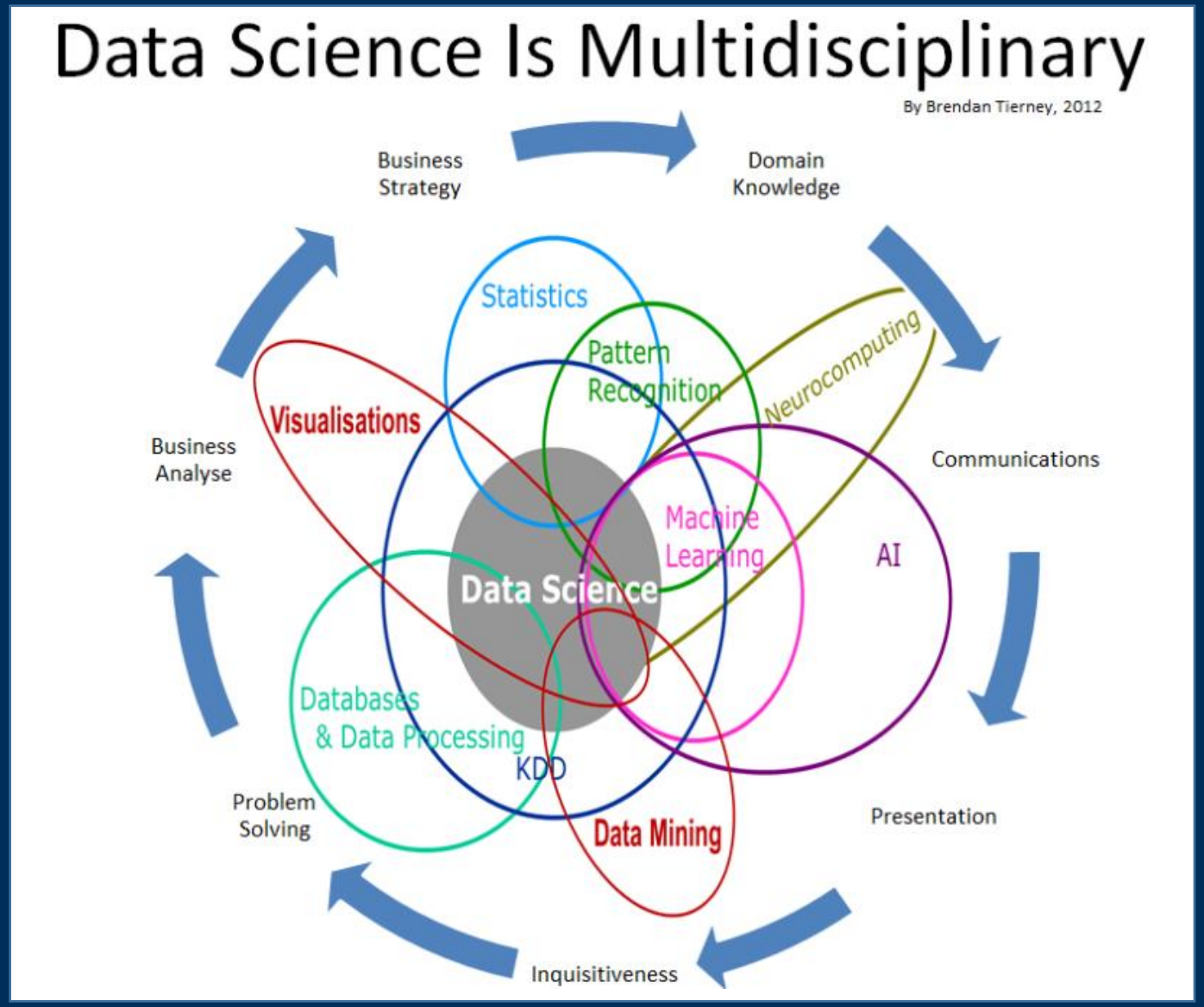

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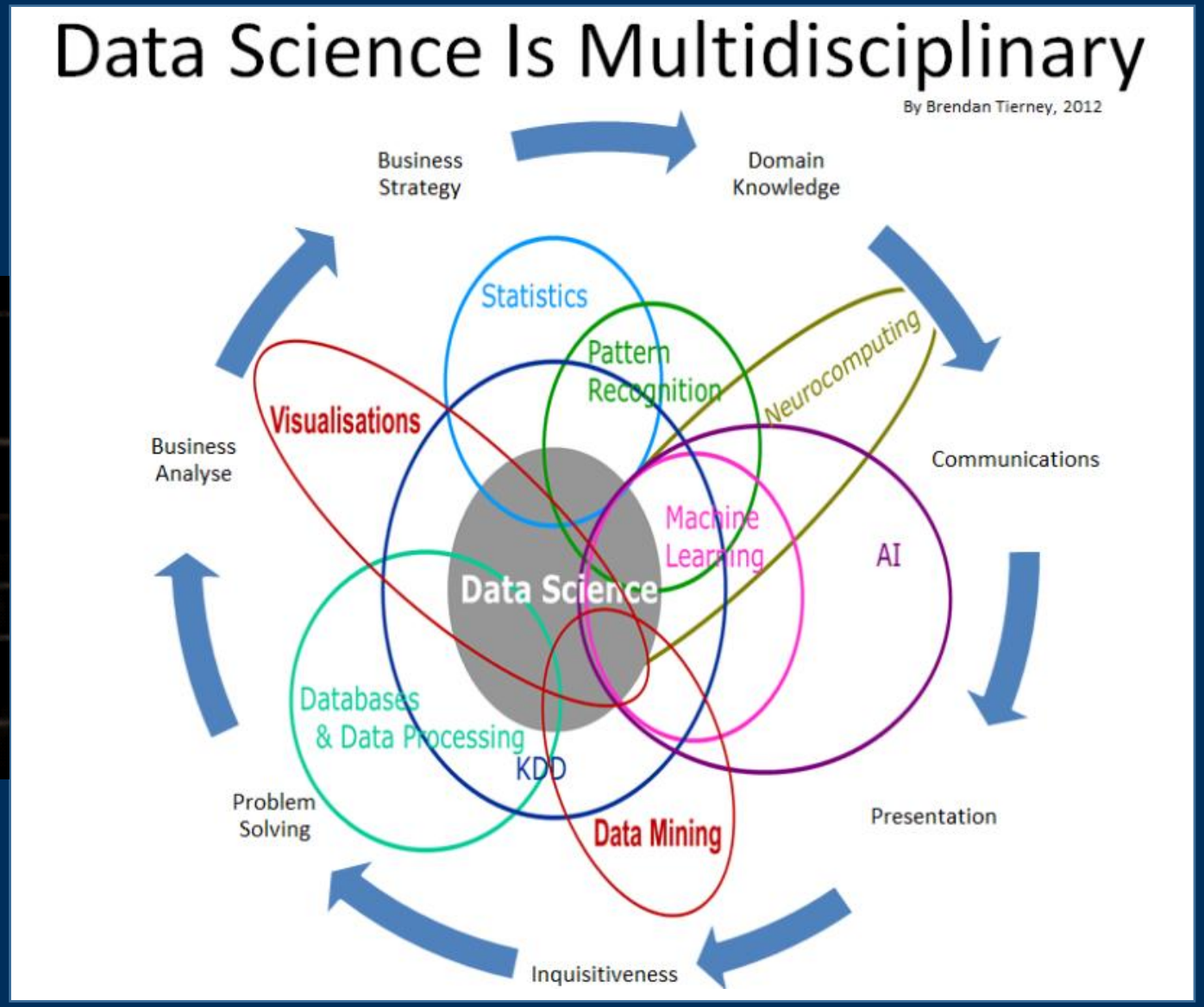
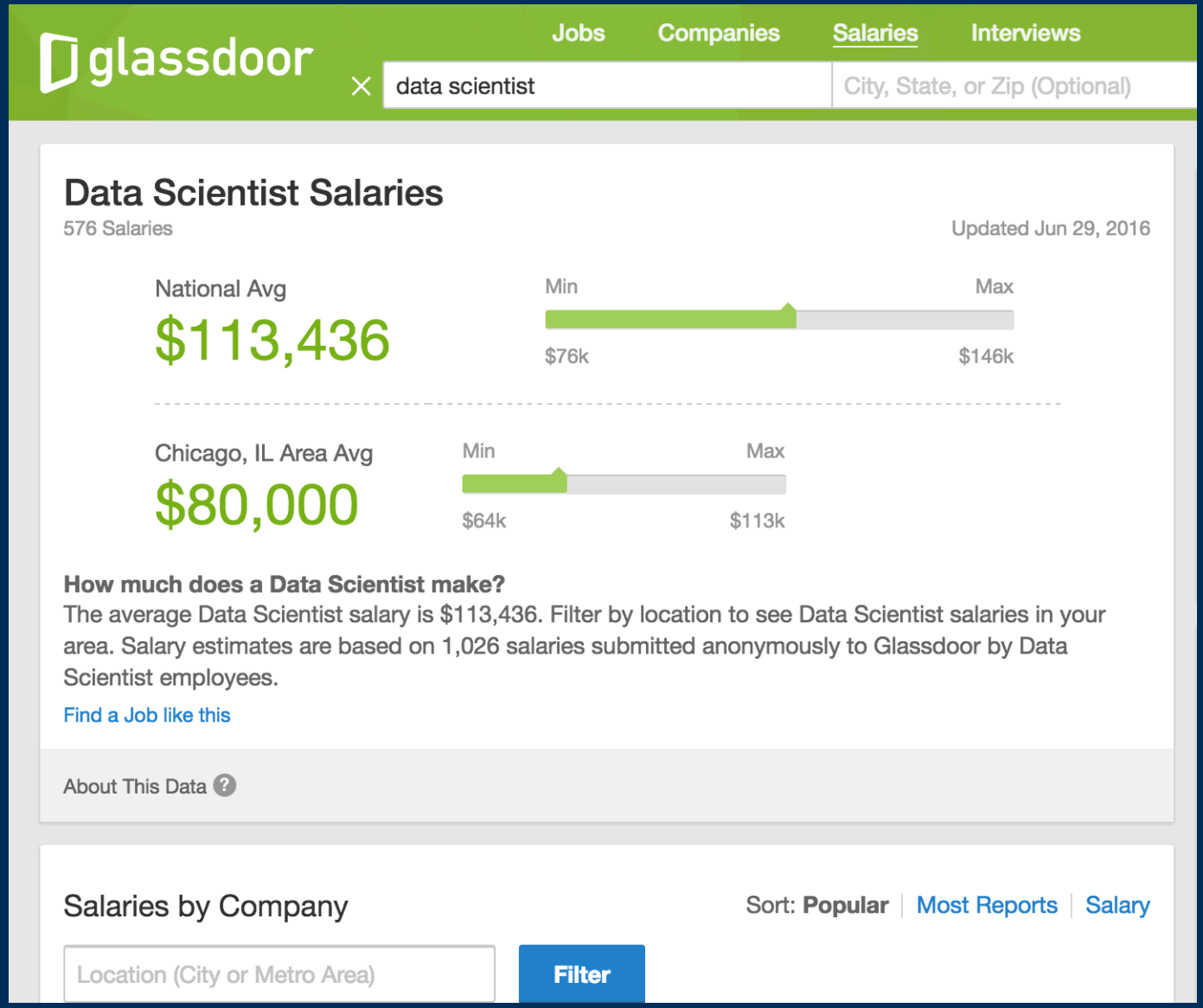


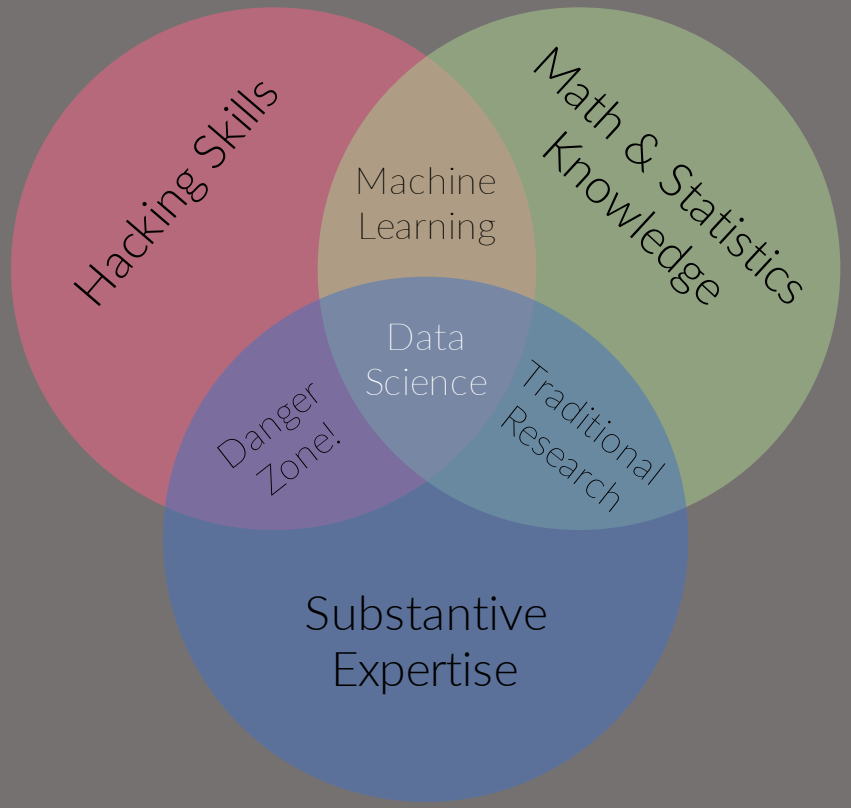
DATA SCIENCE IS EXPENSIVE



DATA SCIENCE

according to Drew Conway, CEO of Alluvium

NOT ALL VENN DIAGRAMS ARE USELESS



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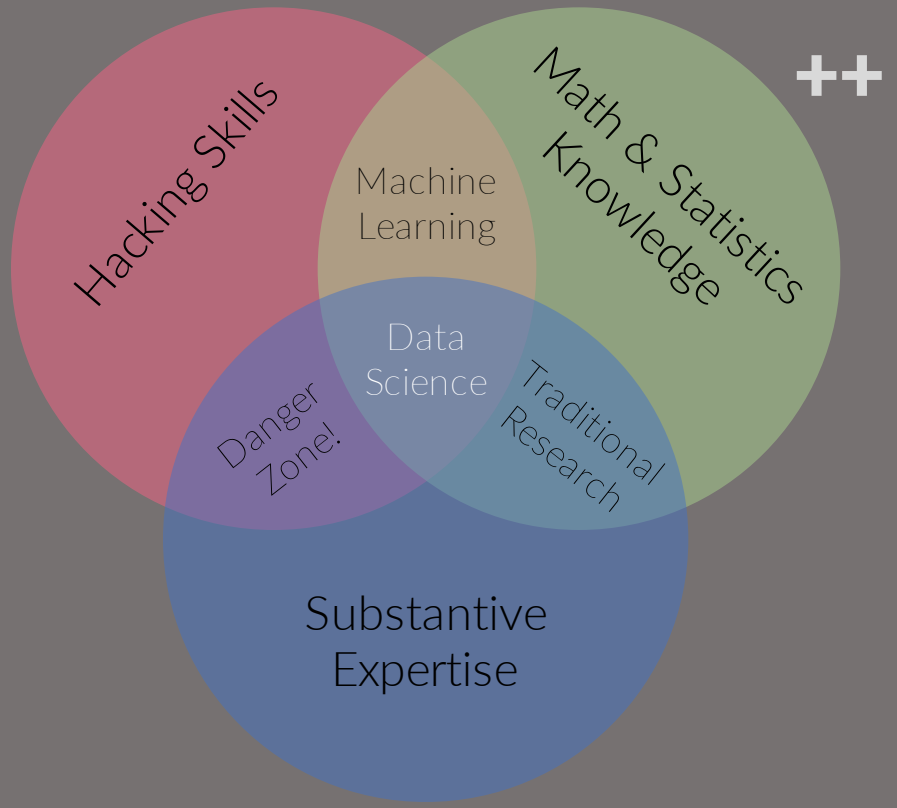
SMALL TEAM?

YOU CAN'T JUST BE A DATA SCIENTIST

You must be your own Product Manager and User Experience Researcher



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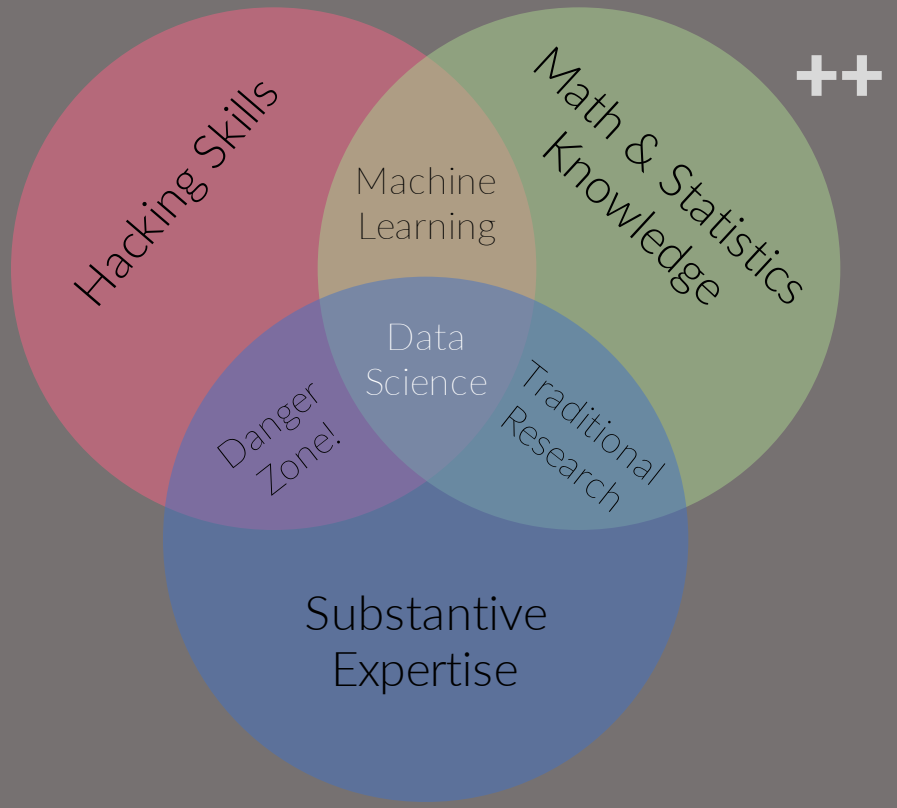

SMALL TEAM?

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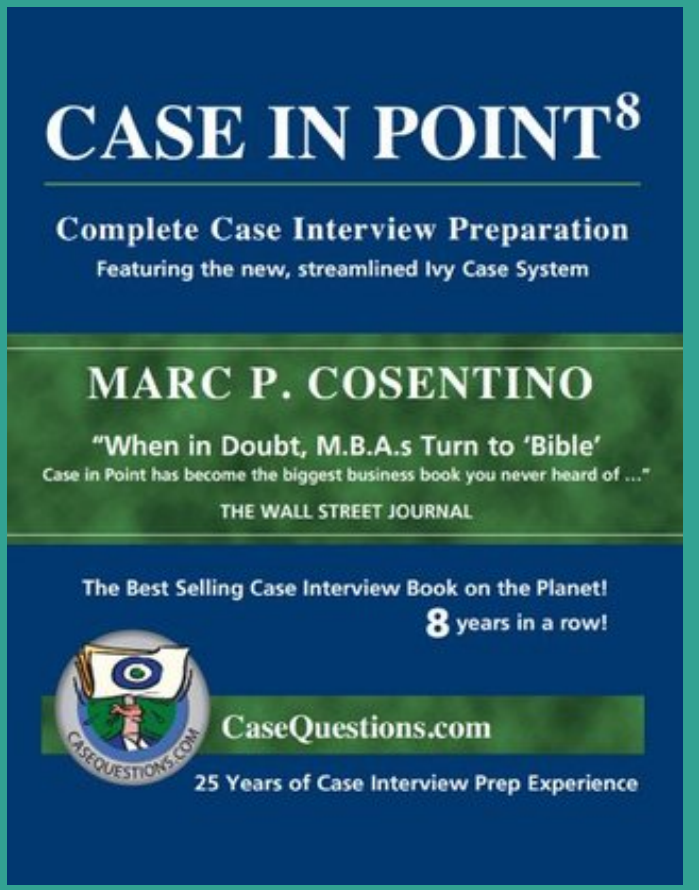
Sorry, but it's probably wise to spend ~20% of your time OVER-COMMUNICATING with stakeholders and UNDERSTANDING their needs

PM + UX

FROM ACADEMIA?

Learn to speak strategy and business

GROSS MARGIN, KPIs, LTV, CAC, ATTRIBUTION, ROI, RETENTION, ATTRITION, MONTHS-TO-PAYBACK, blah blah blah



PM + UX

according to Arthur Geoffrion, UCLA Anderson School of Management

RESERVE THE RIGHT OF PROBLEM FORMULATION

Maxims for Modelers
Arthur Geoffrion
http://www.anderson.ucla.edu/faculty/art.geoffrion/home/docs/Gudmdlg2.htm

PM + UX

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DEVELOP A CLEAR CHARTER AND PROJECT PLAN

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FIND A HIGH-LEVEL CHAMPION

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ESTABLISH PERSONAL CREDIBILITY AND PRODUCE RESULTS EARLY

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INVOLVE THE STAKEHOLDER AND FUTURE USERS AT ALL STAGES

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COMMUNICATE OFTEN AND WELL

Maxims for Modelers
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OUR GOAL

FOCUS

when it works to stay small

provide a customer solution that is usually similar each time, and iteratively add features to this solution so the product expands over time

or

EXPAND

when scale is needed to be impactful

get more team members that complement your own skills, eventually growing a team to allow for increased scope that includes both Decision Science and Data Products

FOCUS

e.g. SaaS Data Product or Marketing Optimization Decision Science

CRITICAL: UX FEEDBACK LOOP

Understand (and help drive) expectations
and deliver each project excellently and completely.

FOCUS

e.g. SaaS Data Product or Marketing Optimization Decision Science

UNIT TEST ALL THE THINGS

While unit tests are always important,
when a product is built iteratively, they are necessary.
Have data factories to spoof typical/edge case data.

FOCUS

e.g. SaaS Data Product or Marketing Optimization Decision Science

DOUBLE THE DOCUMENTATION

Explain the process technically (for future you)
and accurately but simply (for the consumer).

EXPAND

e.g. Recommendation Engines + Attribution Models + Routing Algorithms + …

CRITICAL: QUICK TO "GOOD ENOUGH"

You need to scale the team to be effective,
so produce small, easy wins to earn favor and budget.
Think Pareto's principle: 80% quality at 20% time cost.

EXPAND

e.g. Recommendation Engines + Attribution Models + Routing Algorithms + ...

GET DATA MVPs INTO PRODUCTION

Many Data Products require lots of user data,
so get an MVP out to start, and wait to improve.

EXPAND

e.g. Recommendation Engines + Attribution Models + Routing Algorithms + ...

BE AN EXCELLENT DATA ENGINEER

Projects are often standalone,
so have a reliable ETL process to reduce upkeep.
Upkeep time budget will increase over time.

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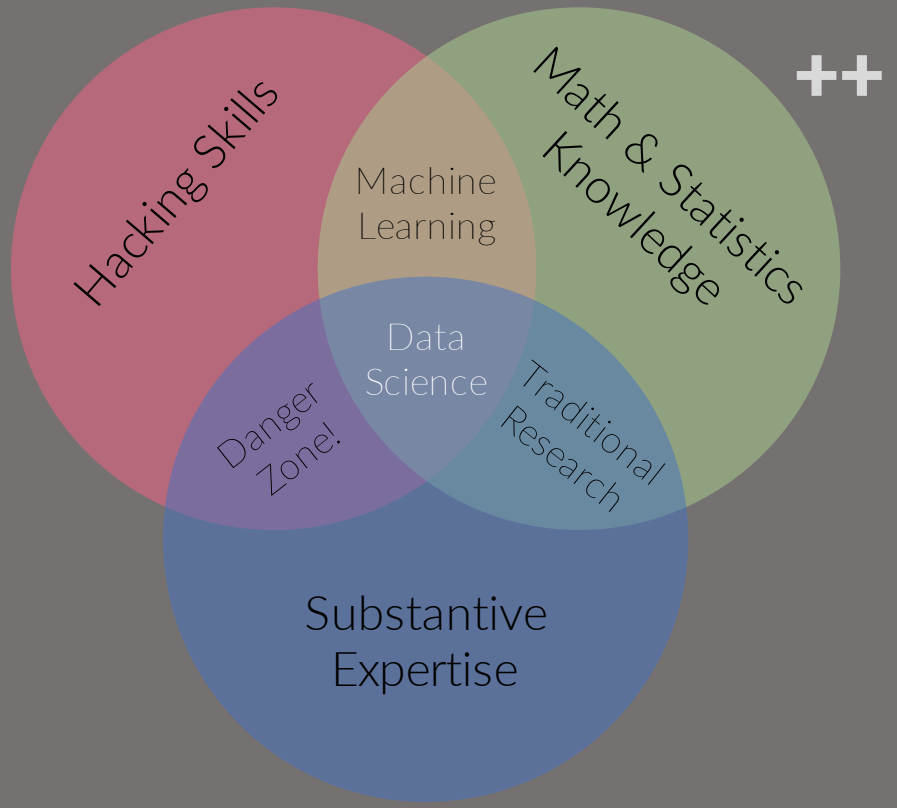

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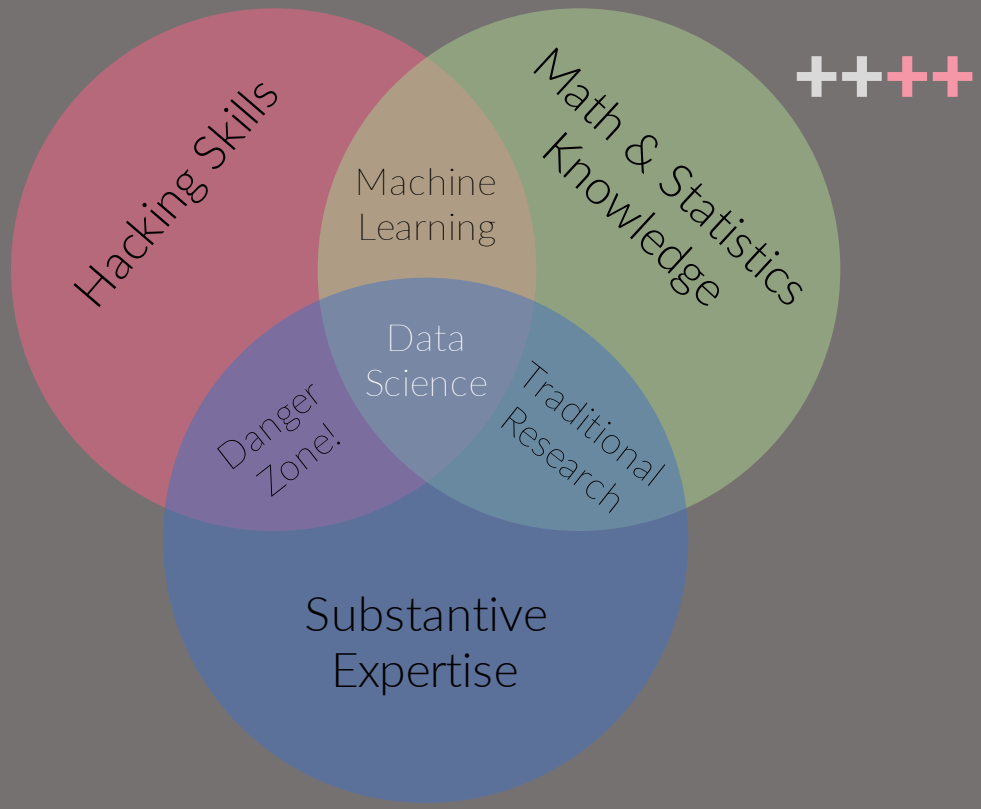

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You must be your own Product Manager
and User Experience Researcher
and Data Engineer and QA Test Engineer

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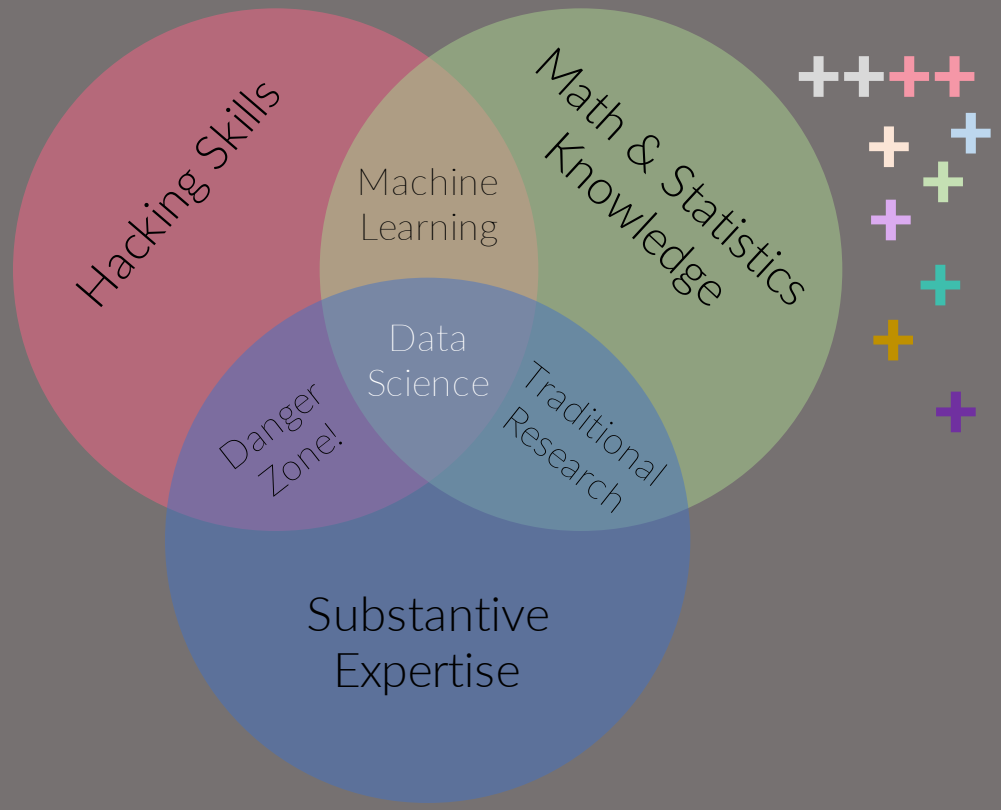



AN ASIDE


AN ASIDE
Lest you feel overwhelmed:
You don't have to be *great* at all of this.

AN ASIDE

Lest you feel overwhelmed:
You don't have to be *great* at all of this.

The beauty of being part of a small team is that what you contribute is probably going to be significantly better than what already exists.

ALSO… NO.

DON’T BE A PHYSICIST.

PEOPLE WHO ACTUALLY DO THESE JOBS?

THEY’RE BETTER THAN YOU AT DOING THEM.

https://xkcd.com/793/

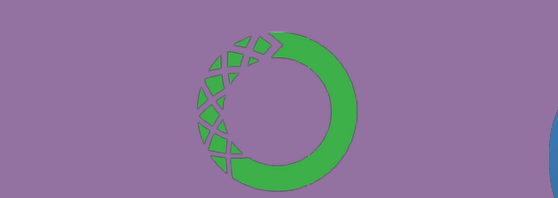
EXAMPLE

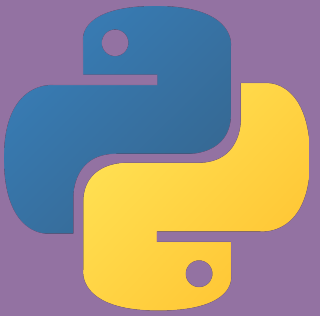
MY EVERYDAY TOOLKIT

EXAMPLE

MY EVERYDAY TOOLKIT

PYTHON 3 + ANACONDA

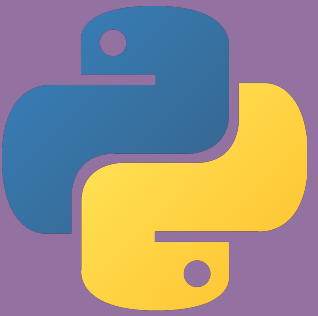




EXAMPLE

MY EVERYDAY TOOLKIT

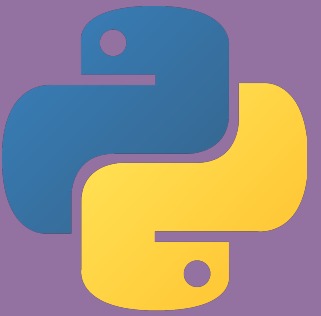
PYTHON 3 + ANACONDA + JUPYTER + PLOTLY



EXAMPLE

MY EVERYDAY TOOLKIT

PYTHON 3 + ANACONDA + JUPYTER + PLOTLY + PANDAS



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EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

DATA COLLECTION

Transaction data in AWS Redshift

EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

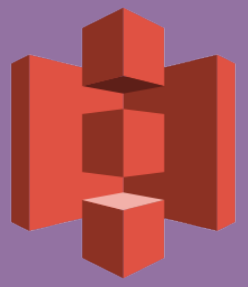
DATA COLLECTION

Transaction data in AWS Redshift

User acquisition data from Google Analytics, AppsFlyer, Branch, Typeform, etc
to Redshift via in-house/external ETL or webhooks + AWS S3 + AWS Lambda





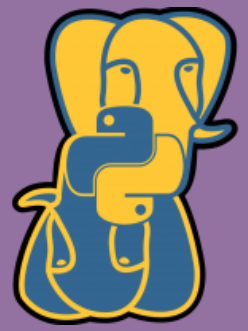




EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

DATA QUERYING

Query customer data using Psycopg2 against Redshift into pandas dataframes



pandas

$$y_i t = \beta' x_{it} + \mu_i + \epsilon_{it}$$

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EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

CHANNEL ATTRIBUTION

Develop an algorithm in pandas to assign for each customer the likelihood that a particular marketing channel was used in their acquisition

pandas

$$y_i t = \beta' x_{it} + \mu_i + \epsilon_{it}$$

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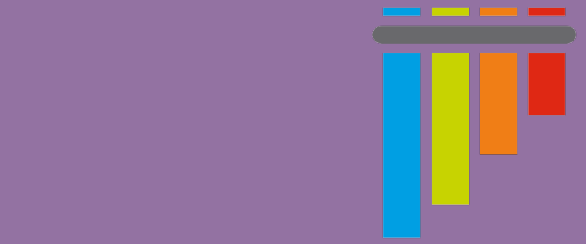
EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

CHANNEL ATTRIBUTION

Develop an algorithm in pandas to assign for each customer the likelihood that a particular marketing channel was used in their acquisition

Data factories spoof customer data for pytest unit tests of acquisition model



EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

COHORT VALUE FORECASTS

Use historical rental trends to predict future revenue in pandas

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MARKETING OPTIMIZATION AT SPOTHERO

COHORT VALUE FORECASTS

Use historical rental trends to predict future revenue in pandas

Regression forecasting + attrition modeling + backtesting in scikit-learn

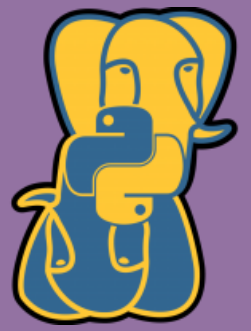
ARIMA forecasting + tests for autocorrelation, stationarity, etc in statsmodels

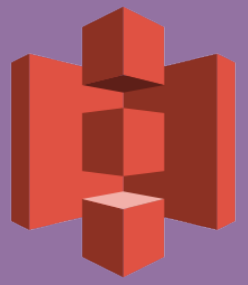
EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

MARKETING SPEND

Move marketing spend csv to Redshift via S3 using Boto 3 + Psycopg2





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MARKETING OPTIMIZATION AT SPOTHERO

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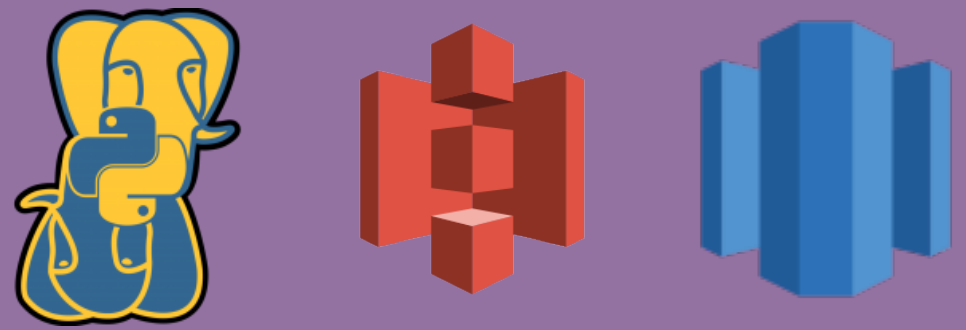
Move marketing spend csv to Redshift via S3 using Boto 3 + Psycopg2

Assign spend to customers (and cohorts) with a divvying algorithm applied using (you guessed it) pandas



EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

CAC/LTV RATIO OPTIMIZATION

All customer acquisition costs (CAC) and lifetime value (LTV) forecasts are written to a data store in Redshift

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All customer acquisition costs (CAC) and lifetime value (LTV) forecasts are written to a data store in Redshift

Marketing analysts use this data in the Looker BI tool to find efficient channels

EXAMPLE

MARKETING OPTIMIZATION AT SPOTHERO

ETL PROCESS

Task dependencies on each branch of this process are handled by Luigi on an AWS EC2 instance

REMINDER:

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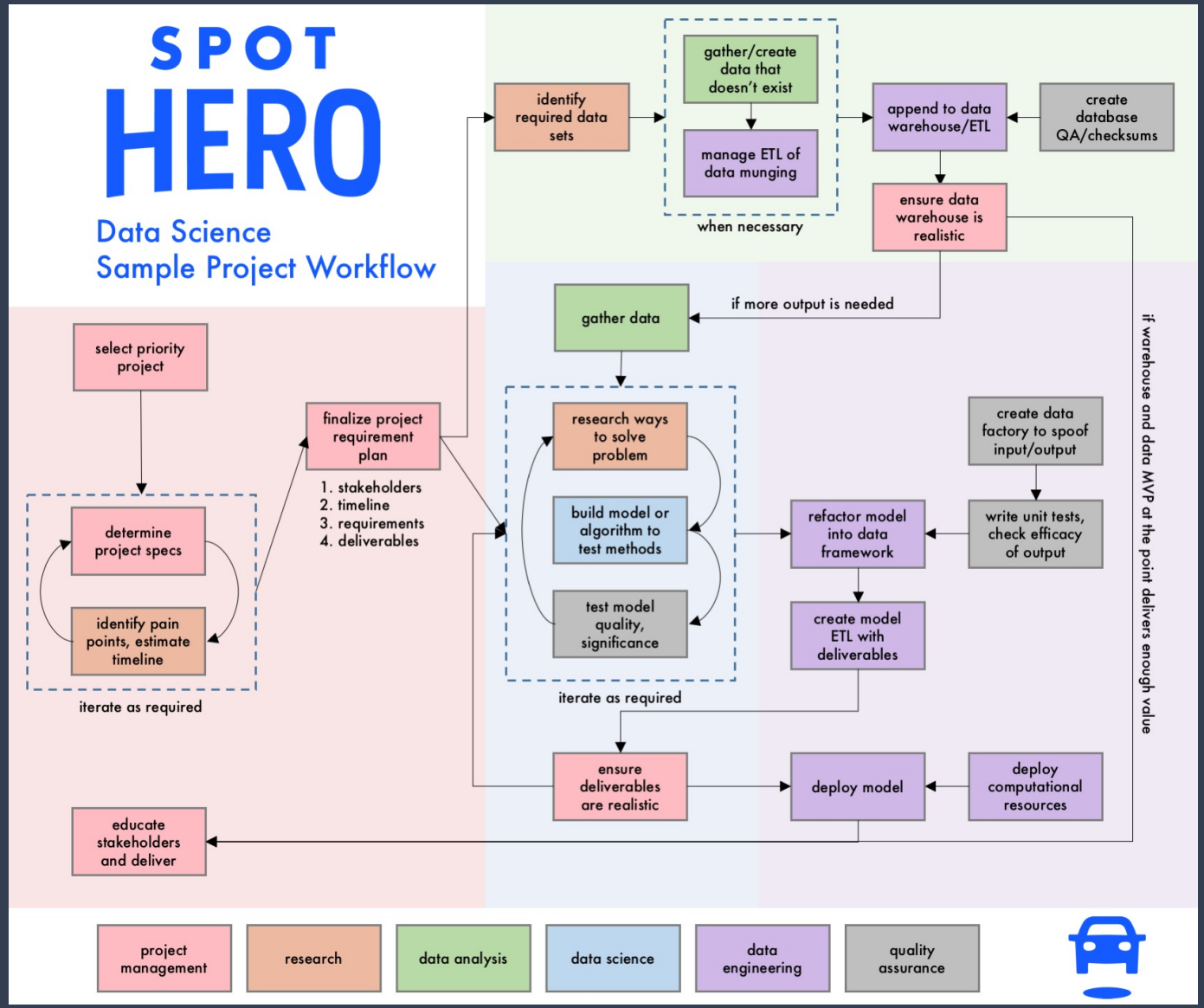
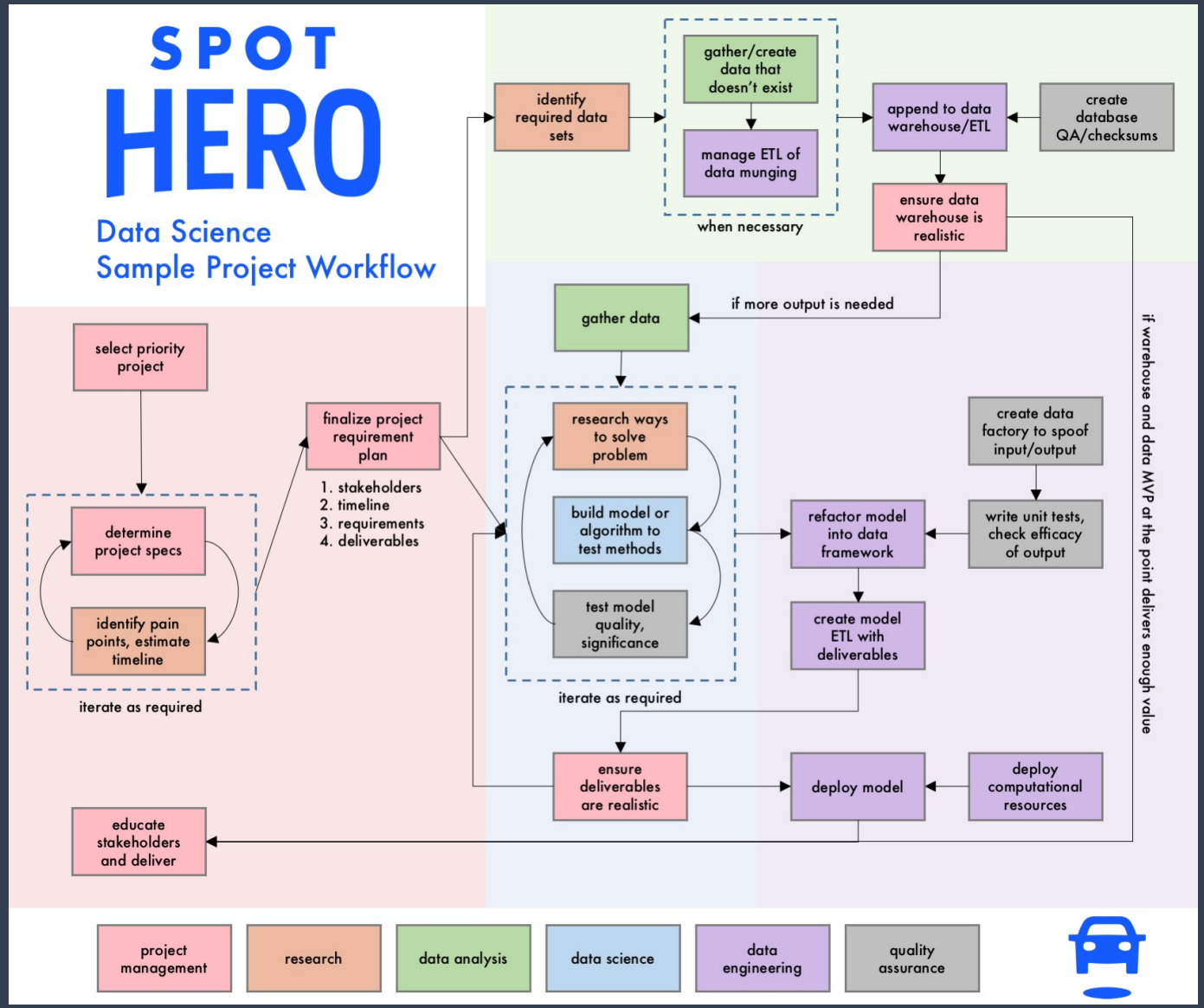


REMINDER:

DATA SCIENCE IS COMPLICATED

TRY YOUR BEST TO BE YOUR OWN:

DATA SCIENTIST
DATA ENGINEER
QA TEST ENGINEER
PROJECT MANAGER
UX RESEARCHER



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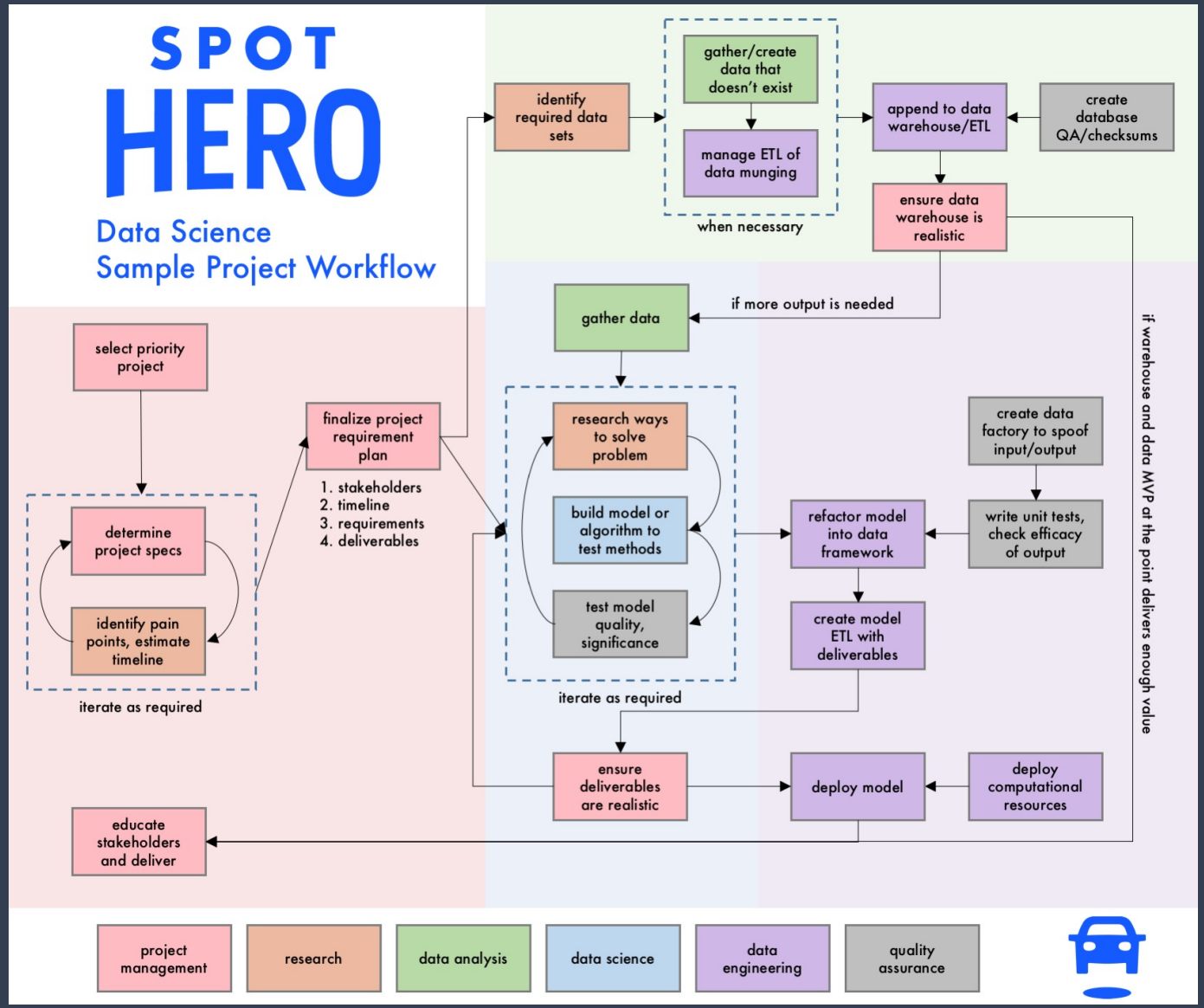

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FURTHER READING

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Maxims for Modelers [Arthur Geoffrion]
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Highly Effective Data Science Teams [Drew Harry]
https://medium.com/mit-media-lab/highly-effective-data-science-teams-e90bb13bb709

Data Engineering Architecture at Simple [Rob Story]
https://github.com/wrobstory/DataEngArchSimple/blob/master/2016_03_29_SimpleDataArch_with_notes.pdf

Data Science Team-Building and Optimization (talk) [Jeremy Stanley]
https://www.youtube.com/watch?v=CqQyrkEvh_8