

Machine Learning Specialization

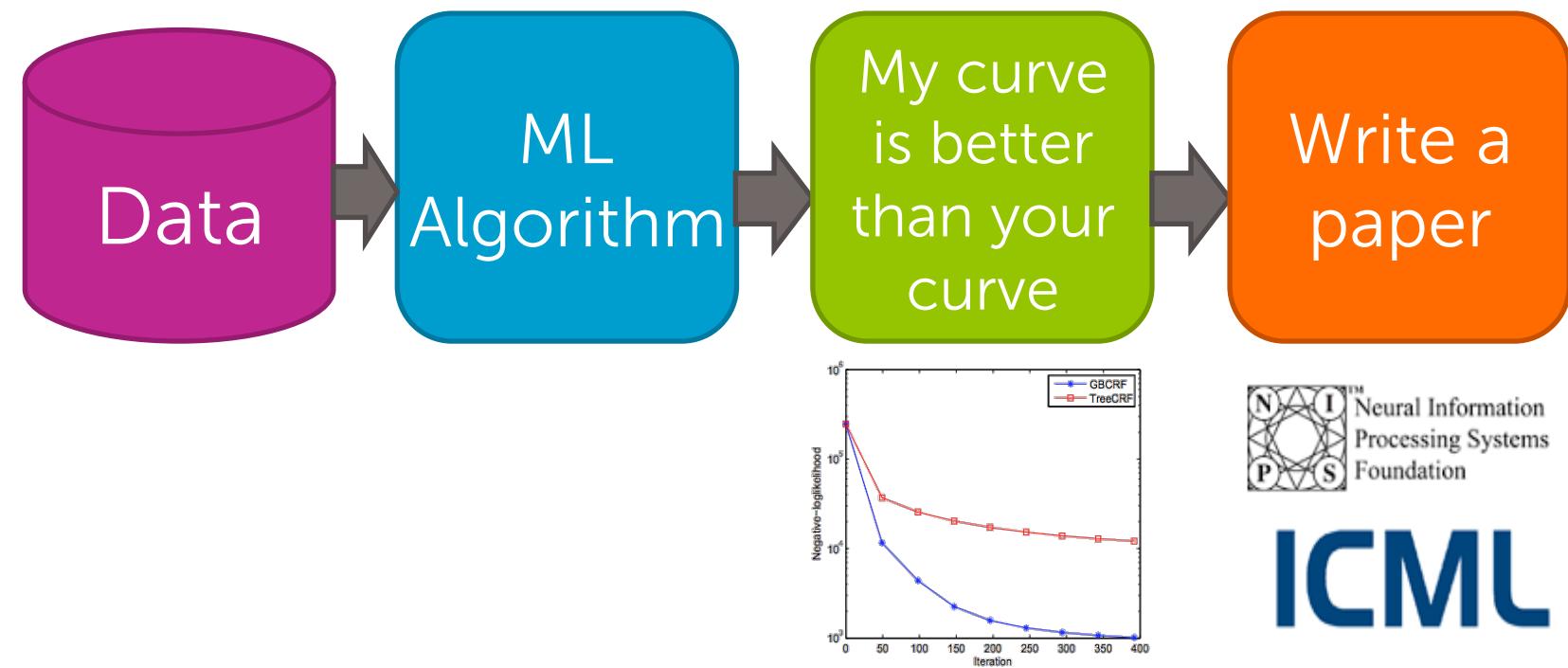
Welcome

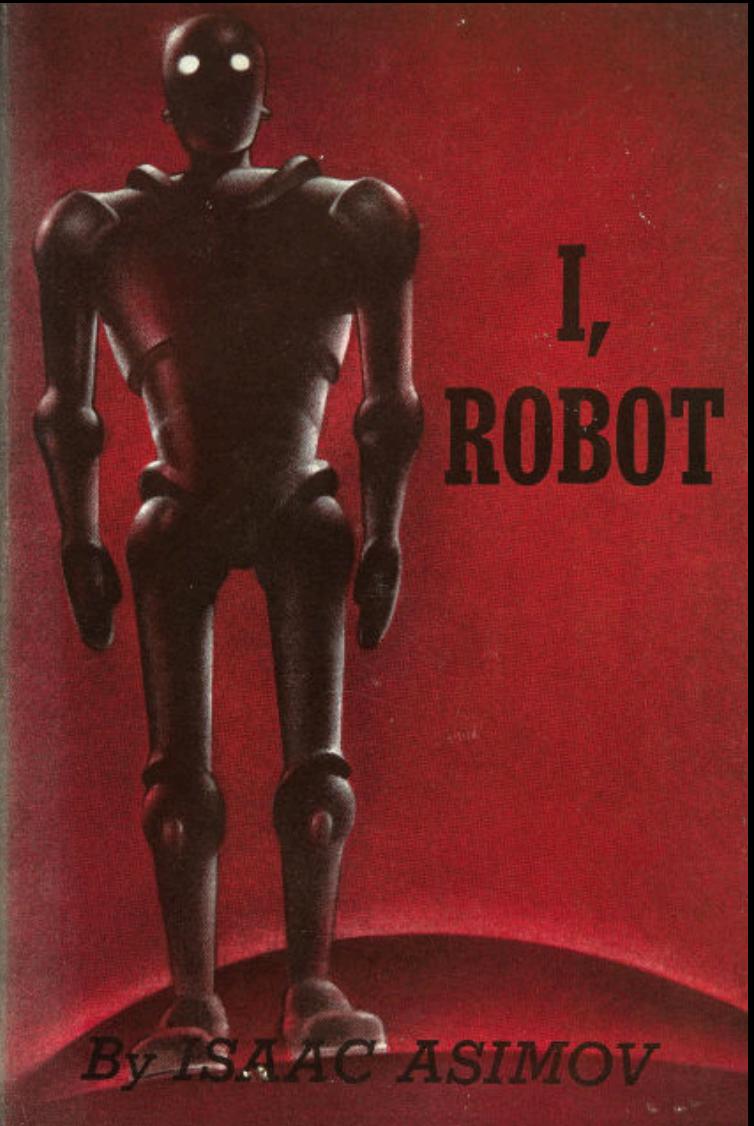
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Machine Learning Specialization
University of Washington



Machine learning is
changing the world

Old view of ML





PANDORA
Music

Google
Adsense
Advertising

glassdoor™
Human
Resources

eHarmony®
Dating

amazon®
Retail

NETFLIX
Movie
Distribution

Google
PageRank
Search

livingsocial®
Coupons

LinkedIn
Networking

Obama'08
Campaigning

Zillow®
Real Estate

Avvo™
Legal
Advice

U
BER
Taxis

RelateIQ
CRM

fitbit
Wearables

Disruptive companies
differentiated by
**INTELLIGENT
APPLICATIONS**
using

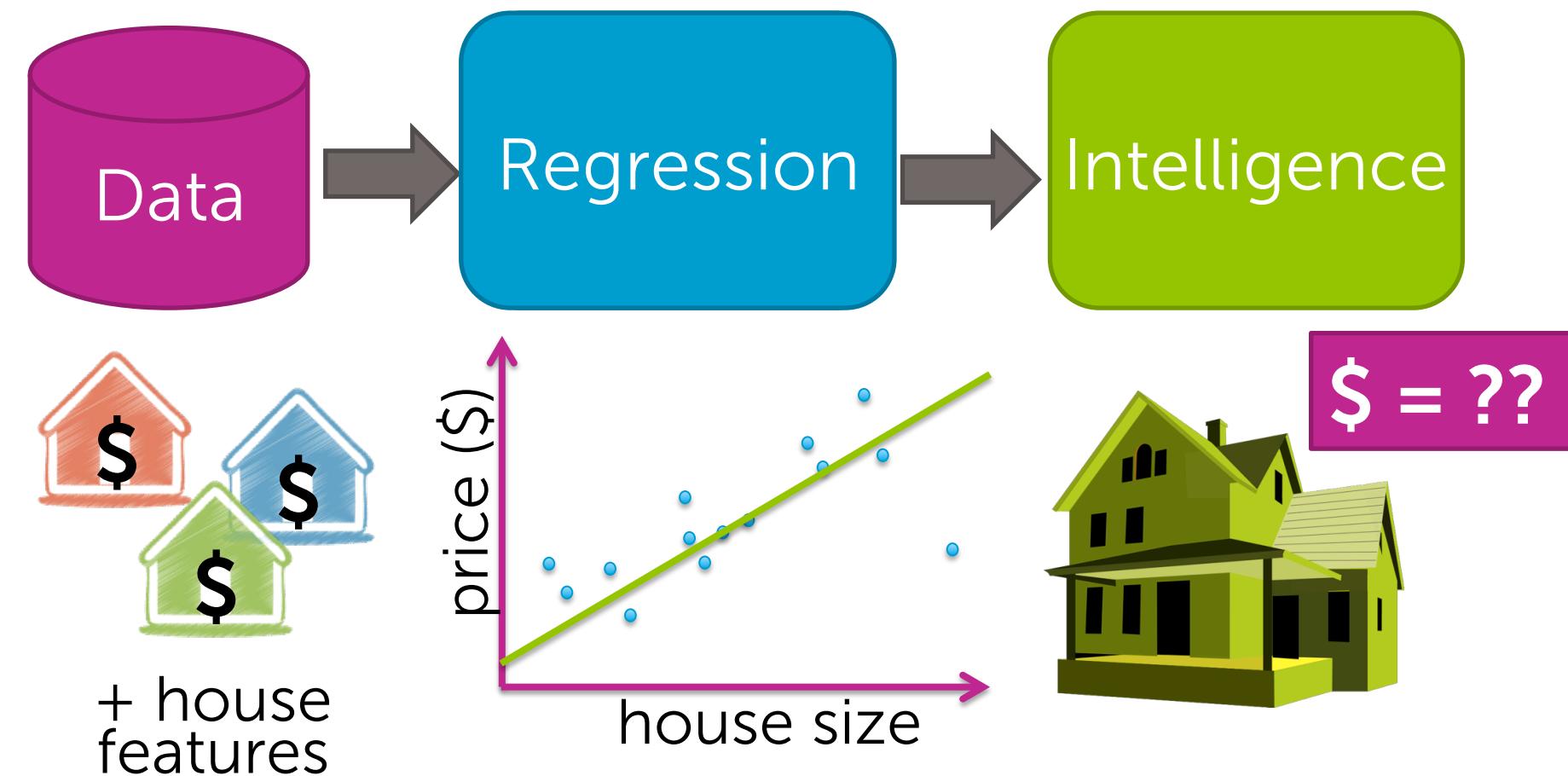
Machine Learning

The machine learning pipeline



ML case studies

Case Study 1: Predicting house prices



Case Study 2: Sentiment analysis



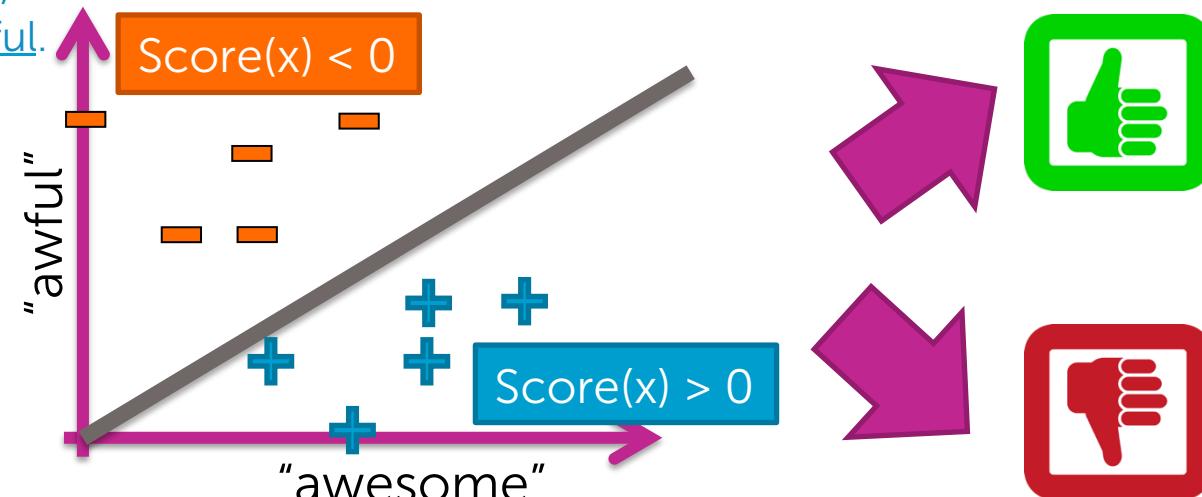
Sushi was awesome,
the food was awesome,
but the service was awful.

All reviews:

★★★★★ 7/21/2015
This is probably my favorite place to eat Japanese in Seattle. My boyfriend and I ordered nigiri of scallop, Japanese snapper (seasonal), and the agedashi tofu and 2 special rolls. I would skip the special rolls, because the nigiri and sashimi cuts is where this place excels. The tofu, as recommended by other Yelpers was amazing. It's more chewy and the sauce/gravy is the perfect amount of flavor for the delicate tofu.

★★★★★ 6/11/2015
Dining here at the sushi bar made me feel like sitting front row to an amazing performance. We didn't have reservations, banged down to the last seat after work, got here breathlessly at 6:10pm, and got the last two seats in the place.

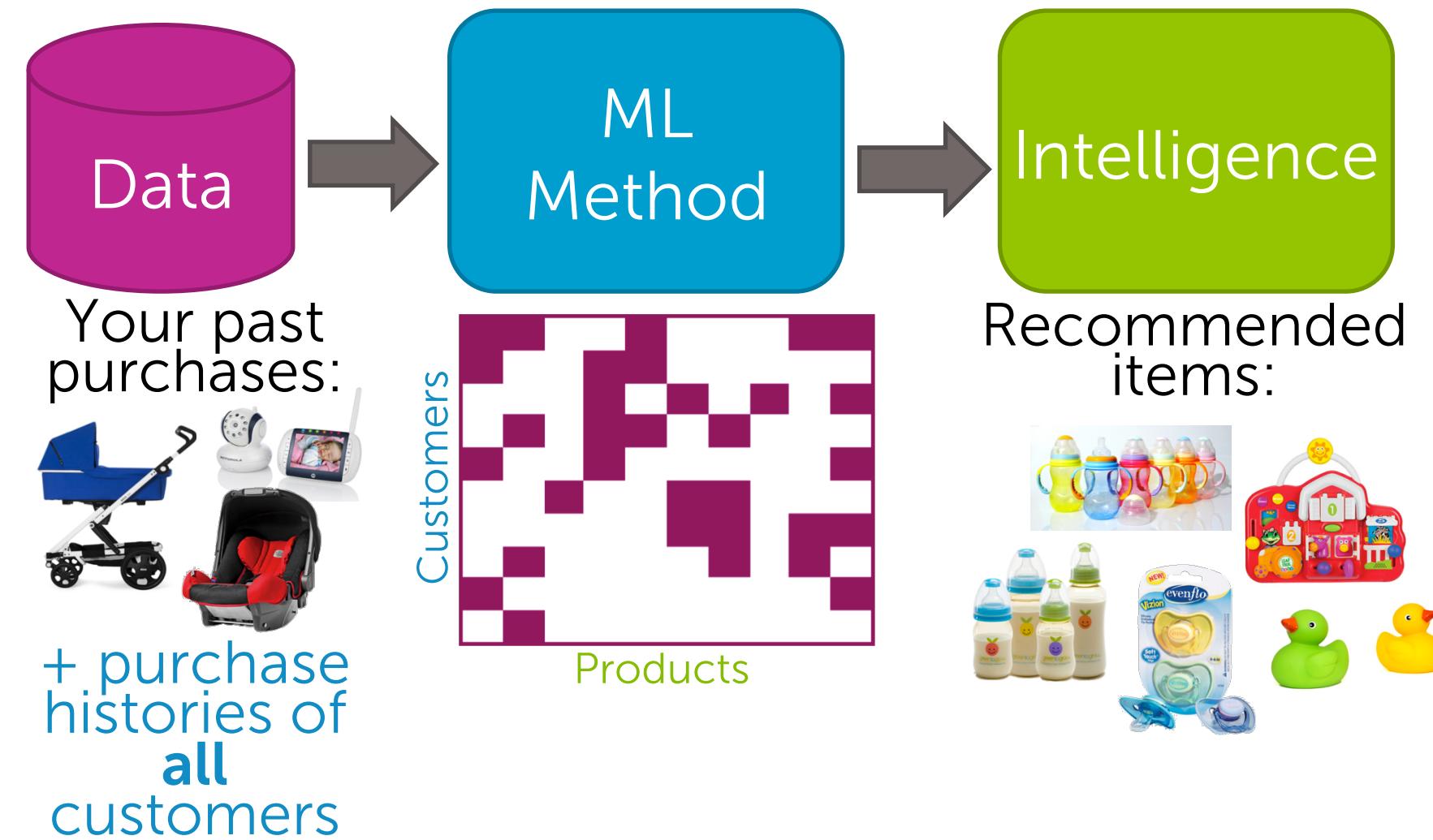
★★★★★ 6/9/2015
I came here having high expectations due to the reviews of this place, but I was bit disappointed. The restaurant is small so do make reservations when you come here. Dishes cost from \$4-26 each and dishes are small.



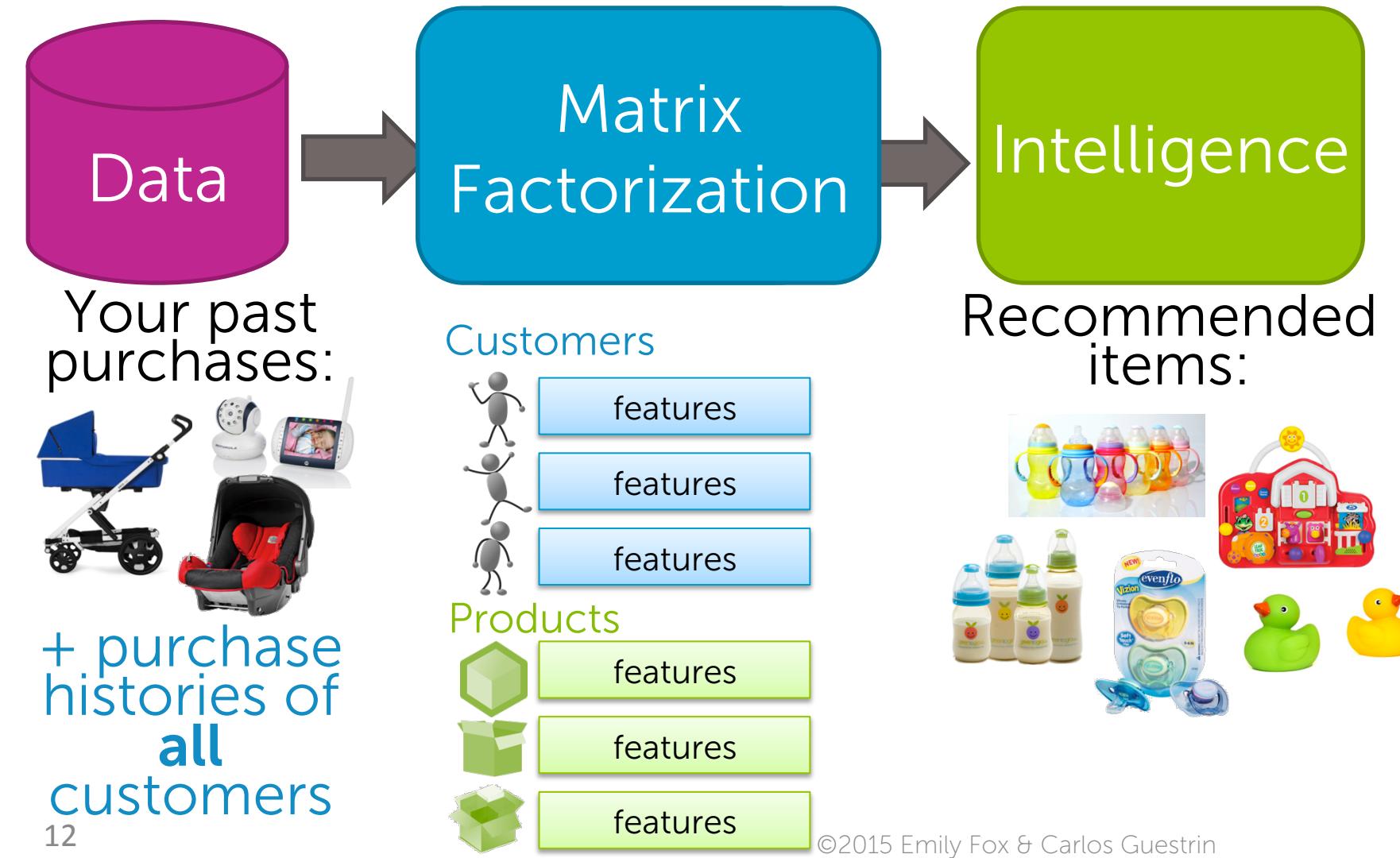
Case Study 3: Document retrieval



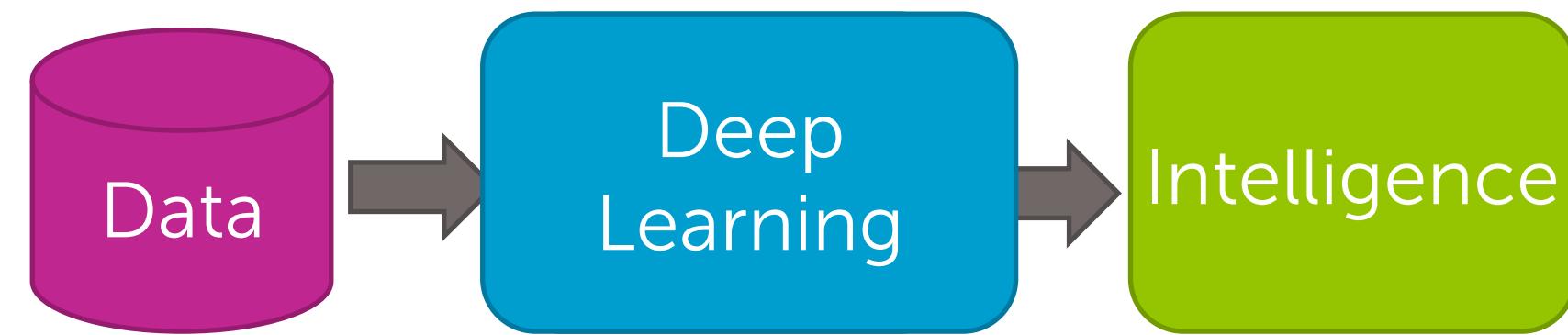
Case Study 4: Product recommendation



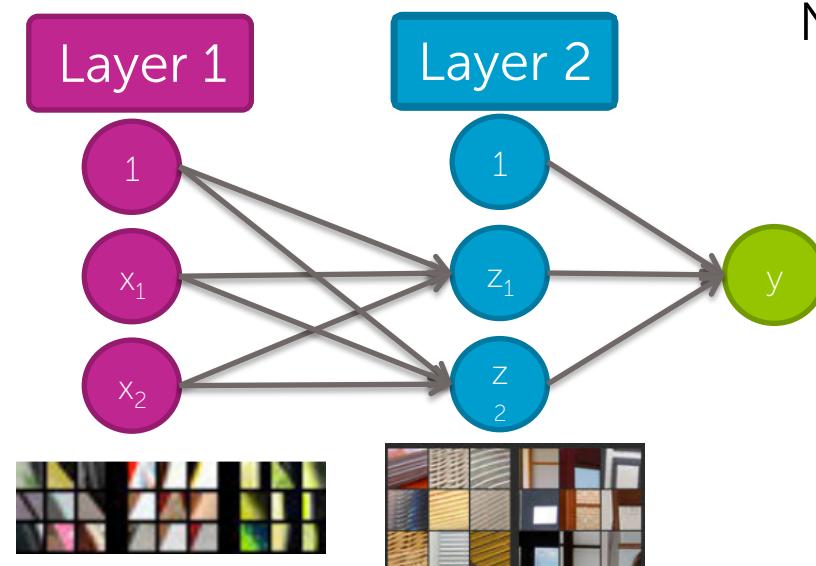
Case Study 4: Product recommendation



Case Study 5: Visual product recommender



Input images:



Nearest neighbors:



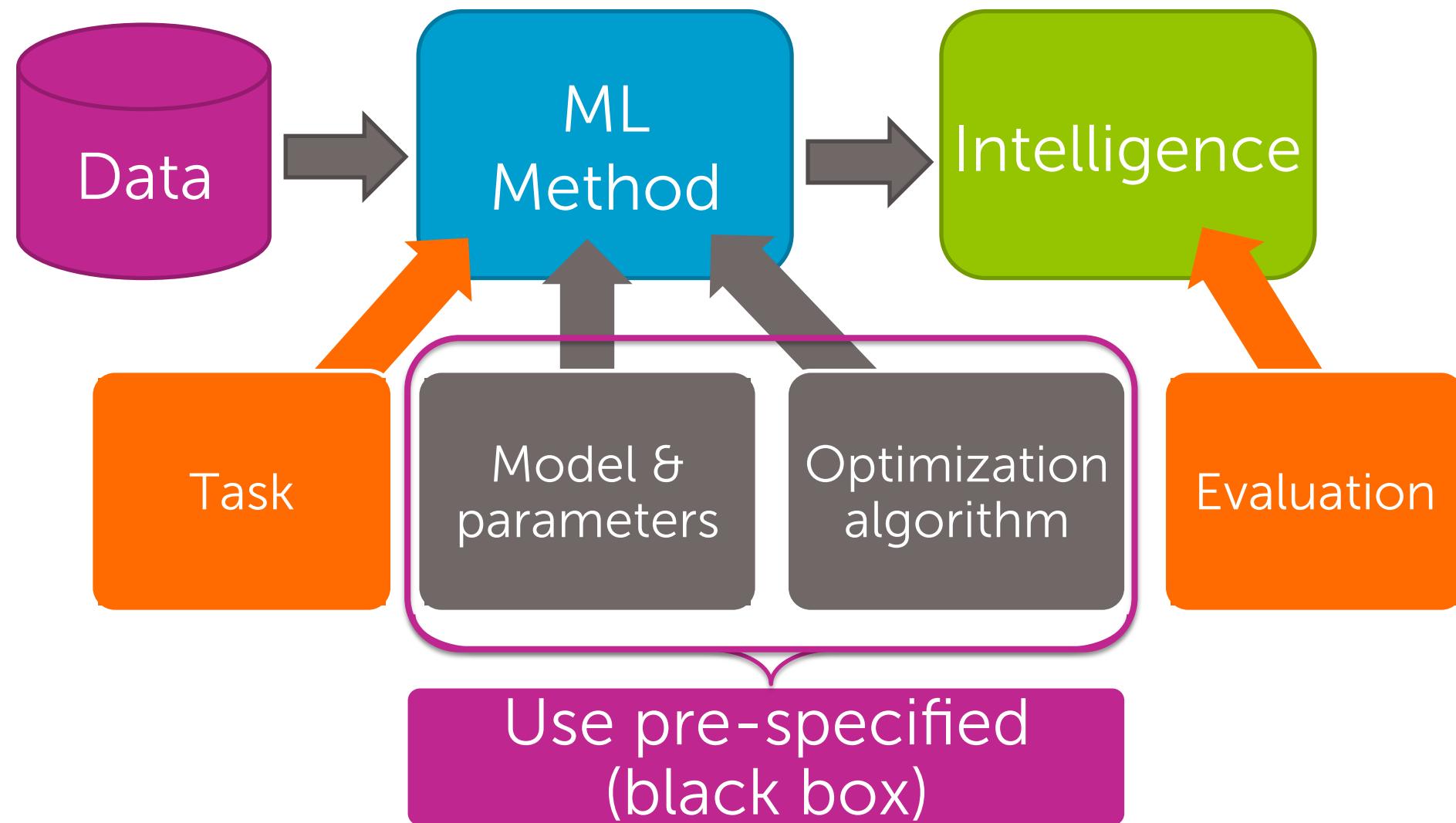
A unique ML specialization



Not like other ML
courses out there...

From use cases to
models & algorithms

First course is about building, evaluating and deploying *intelligence* in each case study...



Subsequent courses provide depth in
models & algorithms, but still use case studies

2. Regression
3. Classification
4. Clustering & Retrieval
5. Matrix Factorization &
Dimensionality Reduction
6. Capstone: Build an
Intelligent Application
with Deep Learning

2. Regression

Case study: Predicting house prices

Models

- Linear regression
- Regularization:
Ridge (L2), Lasso (L1)

Algorithms

- Gradient descent
- Coordinate descent

Concepts

- Loss functions, bias-variance tradeoff, cross-validation, sparsity, overfitting, model selection

3. Classification

Case study: Analyzing sentiment

Models

- Linear classifiers
(logistic regression, SVMs, perceptron)
- Kernels
- Decision trees

Algorithms

- Stochastic gradient descent
- Boosting

Concepts

- Decision boundaries, MLE, ensemble methods, random forests, CART, online learning

4. Clustering & Retrieval

Case study: Finding documents

Models

- Nearest neighbors
- Clustering, mixtures of Gaussians
- Latent Dirichlet allocation (LDA)

Algorithms

- KD-trees, locality-sensitive hashing (LSH)
- K-means
- Expectation-maximization (EM)

Concepts

- Distance metrics, approximation algorithms, hashing, sampling algorithms, scaling up with map-reduce

5. Matrix Factorization & Dimensionality Reduction

Case study: Recommending Products

Models

- Collaborative filtering
- Matrix factorization
- PCA

Algorithms

- Coordinate descent
- Eigen decomposition
- SVD

Concepts

- Matrix completion, eigenvalues, random projections, cold-start problem, diversity, scaling up

6. Capstone:

An intelligent application using deep learning

Build & deploy
a recommender using
product images and
text sentiment



This specialization is for you if...

Level of the specialization

Motto:

*tough concepts made intuitive
and applicable*

minimize prereq knowledge
maximize ability to develop and deploy
learn concepts through case studies

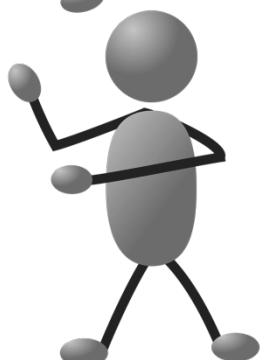
Target audience



Software engineer



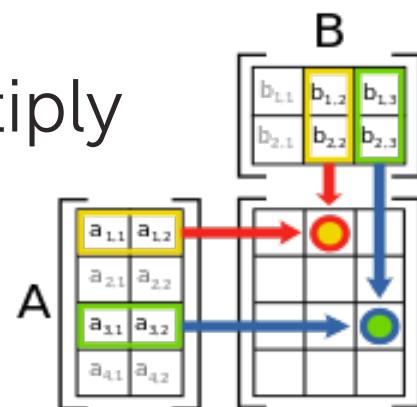
Scientist



Data enthusiast

Math background

- Basic calculus
 - Concept of derivatives
- Basic linear algebra
 - Vectors
 - Matrices
 - Matrix multiply



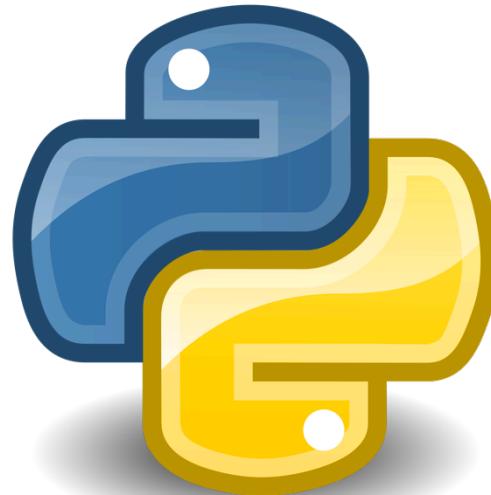
Programming experience

- Basic Python used
 - Can pick up along the way if knowledge of other language

```
    def get_user(self, user):
        """
        Returns a QuerySet of connections for user.
        """
        set1 = self.filter(from_user=user).select_related(depth=1)
        set2 = self.filter(to_user=user).select_related(depth=1)
        return set1 | set2

    def are_connected(self, user1, user2):
        if self.filter(from_user=user1, to_user=user2).count() > 0:
            return True
        if self.filter(from_user=user2, to_user=user1).count() > 0:
            return True
        return False

    def remove(self, user1, user2):
        """
        Deletes proper object regardless of the order of users in argument
        """
        connection = self.filter(from_user=user1, to_user=user2)
        if not connection:
            connection = self.filter(from_user=user2, to_user=user1)
        connection.delete()
---:--- models.py Top L1 (Python AC yas)---
```



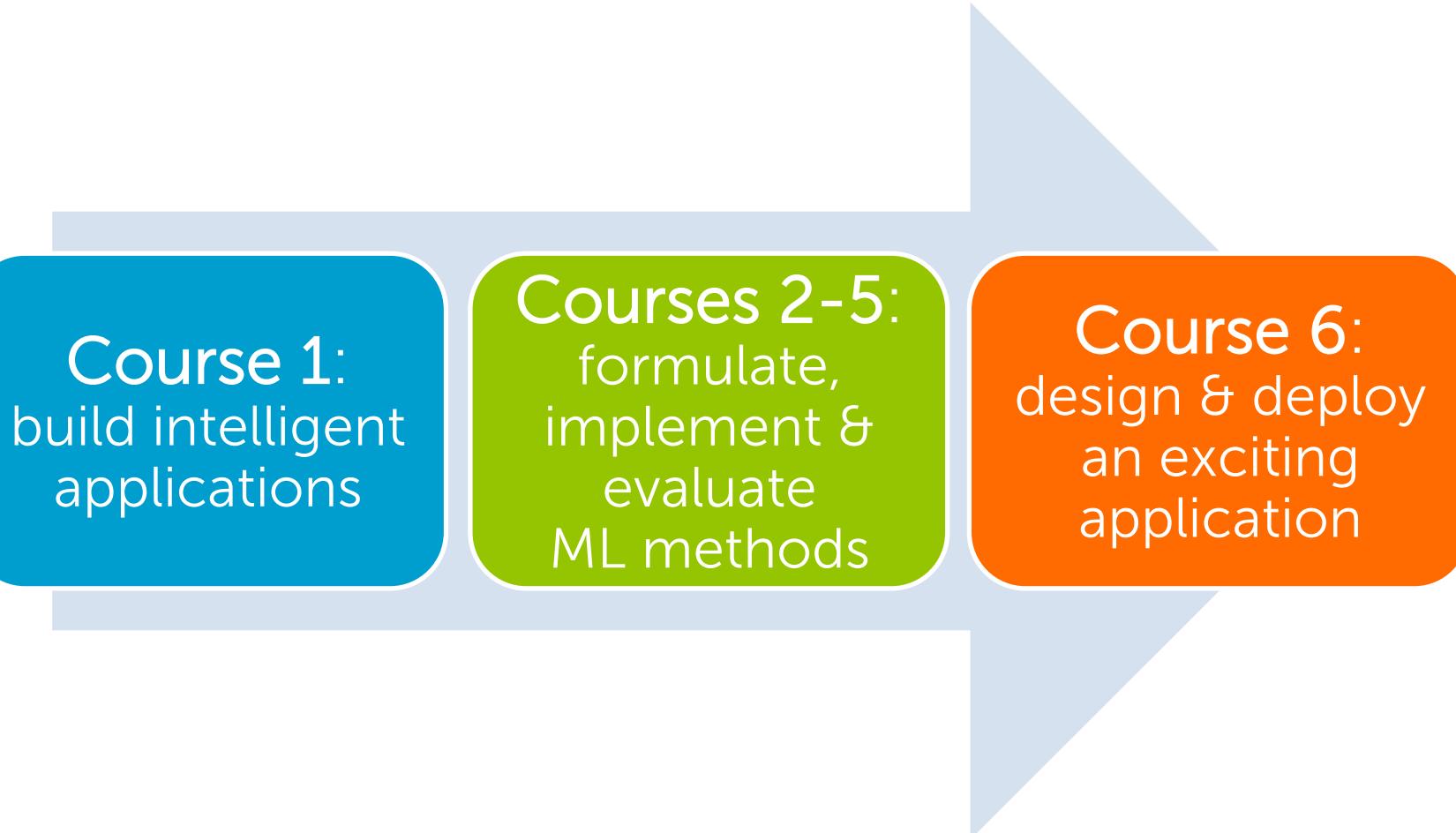
Computing needs

- Basic desktop or laptop
- Access to internet
- Ability to:
 - Install and run Python
 - Store a few GB of data



You'll be able to do
amazing things...

Our journey together...



The Capstone Project: *Build and deploy an intelligent application with deep learning*

An intelligent recommender using images & text

We will do something even more exciting...

