

Wrapping Up and Next Steps

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Learning Objectives

After this lesson, you should be able to:

- Summarize the models we learned in this class and select the appropriate model for your problem at hand
- As next steps, which models you should learn on your own



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Announcements and Exit Tickets

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Q & A



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Review



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Today

Here's what's happening today:

- Announcements and Exit Tickets
- Review
- What models did we learn in this class? Which one should I choose?
Pros and Cons?
- What else did we learn in this class?
- What's next?
- Office hours in class for final projects
- Exit Tickets



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Wrapping Up and Next Steps



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What models did we learn in this class? Which one should I choose? Pros and Cons?

What models did we learn in this class?

Regression

- Linear Regression
- k-Nearest Neighbors
- Regression Decision Trees and Random Forests
- AR, MA, ARMA, and ARIMA

Classification

- Logistic Regression
- k-Nearest Neighbors
- Classification Decision Trees and Random Forests

What model should I use?

- Ask yourself the following questions:
 - Do I have an output or not?
 - If yes, you need to use a supervised learning technique, otherwise, you will use an unsupervised technique
 - In this class we focused on supervised learning techniques. (The exception was the Principle Component Analysis we briefly mentioned)
 - Assuming you have a supervised learning problem, is your output a quantitative variable or qualitative
 - If it is quantitative you will use one of the regression methods, otherwise you will use a classification algorithm

What model should I use? (cont.)

- Is your goal interpretation or prediction?
 - Interpretative regression models are:
 - Linear Regression
 - Simple Regression Decision Trees
 - Predictive regression models are:
 - k-Nearest Neighbors
 - Regression Random Forests
 - AR, MA, ARMA, and ARIMA. Low order of models are relatively interpretable but higher order are not. This is mainly why they are usually only used for prediction

What model should I use? (cont.)

- Interpretative classification models are:
 - Logistic Regression
 - Simple Classification Decision Trees
- Predictive classification models are:
 - Classification Random Forests

Activity | Knowledge Check



EXERCISE

DIRECTIONS (20 minutes)

1. For the following machine learning algorithms that we studied in this class, list the possible pros and cons of each
 - a) Linear Regression
 - b) k-Nearest Neighbors
 - c) Logistic Regression
 - d) Simple Decision Trees
 - e) Random Forests
 - f) AR, MA, ARMA, and ARIMA

DELIVERABLES

Answers to the above questions

Pros and Cons of Linear Regression

▸ Pros

- Intuitive
- Very interpretable
- Easy to compute predictions
- No need to standardize your data

▸ Cons

- Assumes linear association among variables
- Assumes normally distributed residuals
- Outliers can easily affect coefficients

Pros and Cons of k-Nearest Neighbors

▸ Pros

- Intuitive
- Very easy to compute
- Easily capture non-linearity

▸ Cons

- Not interpretable
- Cannot be used if you have sparse data and feature space with dimension of 4 or more
- Need to standardize your data

Pros and Cons of Logistic Regression

▸ Pros

- Fit is fast; faster than Random Forests
- Output is a (posterior) probability which is easy to interpret

▸ Cons

- Limited to binary classification (but *sklearn* provides a multiclass implementation; use ensemble under the hood)

Pros and Cons of Simple Decision Trees

▸ Pros

- Intuitive
- Very interpretable
- Easy to compute predictions
- No need to standardize your data

▸ Cons

- Low predictable power

Pros and Cons of Random Forests

▸ Pros

- Good predictive power
- Easy to compute predictions
- No need to standardize your data

▸ Cons

- Not interpretable

Pros and Cons of AR, MA, ARMA, and ARIMA

▸ Pros

- AR – good for smoothing patterns
- MA – good for tackling shocks
- ARMA – good for smoothing patterns and tackling shocks
- ARIMA – good for smoothing patterns and tackling shocks; also takes care of linear trends in the model

▸ Cons

- Not that interpretable (except when p and q are small)



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What else did we learn in this
class?

What else did we learn in this class?

- We discussed how important it was to tidying up data
 - Tidying data is one of the most fruitful skill you can learn as a data scientist. It will save you hours of time and make your data much easier to visualize, manipulate, and model

What else did we learn in this class? (cont.)

- Over the course, we improved our Python fluency
 - *pandas* dataframes and other Python data structures (e.g., dictionaries)
 - Loops and conditionals
 - Write basic functions to simplify our life and avoid code duplication (e.g., transforming variables on the training set then on the testing set)
 - Primer on object oriented programming

What else did we learn in this class? (cont.)

- We are no longer afraid of statistics! The following should feel very familiar now:
 - Two-Tail Hypothesis Testing
 - Normal, Student's t-, and F-distributions
 - z-scores, t-values, and p-values

What else did we learn in this class? (cont.)

- Validation
 - Divide your dataset into a train and a test sets. Train with training Data and Test it with test data. If you have a large dataset, using validation is always preferred
- Cross-Validation
 - Divides data into chunks. Then train your model on all groups but one, and then test it on the one chunk left out. Repeat on all groups. This way, you are not wasting any data. Especially useful when you have a small dataset
- Can we combine Validation and Cross-Validation?
 - Not only can you, but you should... Develop your model and tune it up using cross-validation (on your training data). Then train a final model using all your training data and then test it on your test set (completely unseen data)

What else did we learn in this class? (cont.)

- Git/GitHub

- GitHub has become such a staple amongst the open-source development community that many developers have begun considering it a replacement for a conventional resume and some employers require applications to provide a link to and have an active contributing GitHub account in order to qualify for a job



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What's next?

What's next?

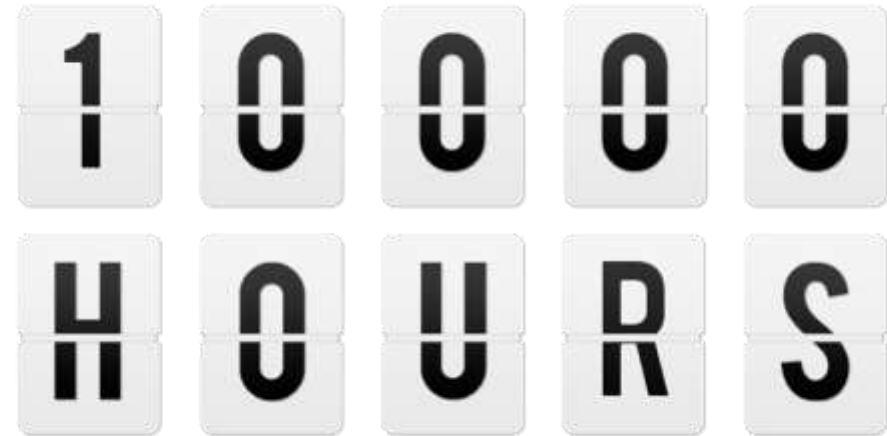
- A lot!
- This course was just an introduction to data science
- We focused on learning just a handful of models but learning them well. There are of course many more...

In short term, consider spending time learning or doing a deep dive on the following machine algorithms:

- Principal Component Analysis (a.k.a., PCA) for dimensionality reduction as a pre-processing step for other machine learning algorithms
- Supervised
 - Regularization (for linear regression and logistic regression)
 - Boosting (e.g., on Regression/Classification Decision Trees)
- Unsupervised
 - k-Means Clustering

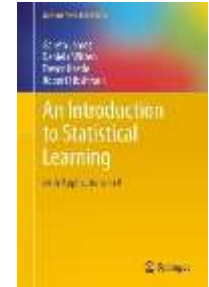
Get your Hands Dirty, a.k.a., Practice, Practice, Practice...

- ▶ Kaggle (<http://www.kaggle.com>) competitions are a great way to practice everything we've learned in this class. And it's fun too!
 - ▶ Azi, Jeremiah, and Ivan are spending way too much time in this site...
 - ▶ You can compete by yourself but you can also team up with your fellow GA classmates!
- ▶ If Kaggle is not your thing, you should consider joining a study group if you haven't done so already



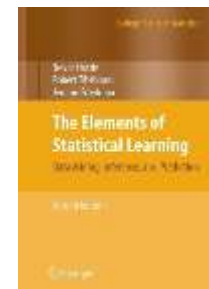
Longer term, consider the following resources

- ▶ An Introduction to Statistical Learning: with Applications in R (by James et al.). The e-book is available free-of-charge [here](#)



- ▶ A MOOC (Massive Open Online Courses) called Statistical Learning covering the book above is usually offered by Stanford also free-of-charge once a year during the winter. (now self-paced!) Check it out [here](#)

- ▶ For a more advanced treatment of these topics, check out The Elements of Statistical Learning: Data Mining, Inference, and Prediction (by Hastie et al.). And yes, the e-book is also free... ([here](#))



The logo consists of a solid black circle containing the white letters "DS" in a bold, sans-serif font.

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Q & A

Next Class

Flexible Class Session #3 | Market Segmentation



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Exit Ticket

Don't forget to fill out your exit ticket [here](#)

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