Master in Data Science – Introduction

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Why data science?

The intelligente use of data:

- has become a source of competitive advantage
    - Better knowledge about the market
    - Better knowledge about your customers

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The data science process

Data $\rightarrow$ Information $\rightarrow$ Decision

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Data → Information → Decision

The goal

Data-Driven Decision Making

What is a data scientist?

Key skills

- Fitting in an **organization**, leading projects in a heterogeneous environment, aligning with strategy
- Data-Analytic **Thinking**
- How to extract **knowledge** from data

The three facets of a data scientist

- Functional (domain knowledge)
- Analytical (how to extract knowledge from data)
- Technical (how to implement the data science process)

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The three facets of a data scientist

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Question

- Are the three facets equally important?
- Which facet is the most important?
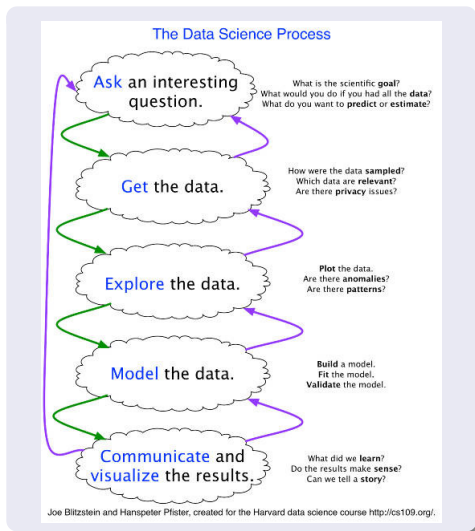
Skills demanded in job postings

Analytical skills

- **Machine Learning**
- **Statistics**
- Bias towards engineering and scientific backgrounds

Technical skills

- **R**
- **Python**
- **SQL**
- **Hadoop, Spark and Big Data** (covered only partially)
- Visualization technologies (**Tableau**, Qlik)
- Excel

The Data Science process

The Data Science Process

Ask an interesting question.
What is the scientific **goal**?
What would you do if you had all the **data**?
What do you want to **predict** or **estimate**?

Get the data.
How were the data **sampled**?
Which data are **relevant**?
Are there **privacy** issues?

Explore the data.
Plot the data.
Are there **anomalies**?
Are there **patterns**?

Model the data.
Build a model.
Fit the model.
Validate the model.

Communicate and visualize the results.
What did we **learn**?
Do the results make **sense**?
Can we tell a **story**?

Joe Blitzstein and Hanspeter Pfister, created for the Harvard data science course http://cs109.org/.

1. Ask a question
   - *Domain expertise*
2. Get and prepare the data
   - *Python, Pandas, R*
3. Explore the data
   - *Pandas, Matplotlib, R, Spark, Tableau*
4. Model the data
   - *Python Scikit-Learn, R, Spark*
5. Communicate the results
   - *Tableau*

`http://www.kdnuggets.com/2016/03/data-science-process-rediscovered.html`

But it is always iterative...

Very rarely (never?) you will do it in just one pass

https://en.wikipedia.org/wiki/Cross_Industry_Standard_Process_for_Data_Mining

What kind of questions can we answer to?

Machine Learning & Statistics Applications

Supervised Learning	Unsupervised Learning	Reinforcement Learning
• Classification • Regression • Ranking	• Clustering • Association Mining • Segmentation • Dimension Reduction	• Decision Process • Reward System • Recommendation Systems

http://www.kdnuggets.com/2015/09/questions-data-science-can-answer.html

What kind of questions can we answer to?

Classifications of questions

- Is this *A* or *B*?
    - Binary classification
- Is this *A*, *B*, *C* or *D*?
    - Multi-class classification
- Is this normal or weird?
    - Anomalies detection
- How much or how many?
    - Regression
- How is this data organized?
    - Unsupervised learning
    - Dimensionality reduction
- What should I do now?
    - Recommendation systems

The (main) program

- **Intro to data science**
  - Setup environment, working with the command line, intro to Git
- **Data analysis**
  - Python for Data Analysis
  - Intro to Statistical Programming (R)
- **Machine Learning and Statistics** (R, Python)
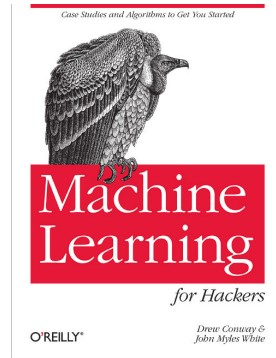 - Including a brief introduction to **Deep Learning**
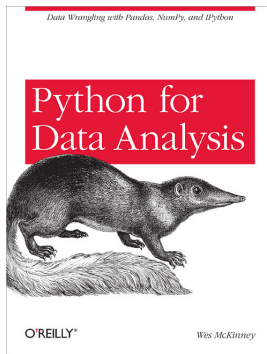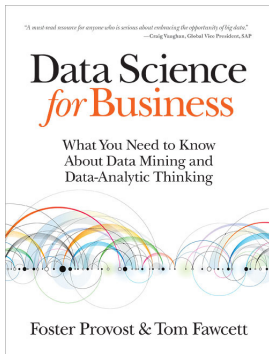- **Big Data**
  - Very brief intro to Hadoop and Spark, using Python
  - First steps in Google Cloud Platform
- **Visualization and Business Intelligence**
  - Dashboards development with Tableau
  - Brief intro to D3.js

Recommended books

Share promiscuously

You need visibility

- Use the social networks to position yourself as a data scientist
  - **Crucial:** Profile in **LinkedIn** and share, share, share!
  - Share frequently about your progress in the master
- Share your code in **Github** or Bitbucket
  - Try to use it frequently, so it always shows recent activity
  - Don't worry if you don't know Git, we will see in the first session
- Don't mix (too much) your personal postings with your data scientist postings
  - For instance, use Facebook for your personal network, and Twitter for your professional postings

Recommended readings

Amadeus Data Scientists series

`http://www.amadeus.com/blog/tag/data-scientist/`

Guía de las profesiones de Internet

`http://www.avanzaentucarrera.com/llegaraser/`
`profesiones-y-profesionales-de-internet`

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Key ideas to remember during the master

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Key ideas to remember during the master

- Extracting useful knowledge from data to solve business problems can be treated systematically by following a process with reasonably well-defined stages.
- From a large mass of data, information technology can be used to find informative descriptive attributes of entities of interest.
- If you look too hard at a set of data, you will find something – but it might not generalize beyond the data you are looking at.

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- Formulating data science solutions and evaluating the results involve thinking carefully about the context in which they will be used.

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Key ideas to remember during the master

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- From a large mass of data, information technology can be used to find informative descriptive attributes of entities of interest.
- If you look too hard at a set of data, you will find something – but it might not generalize beyond the data you are looking at.
- Formulating data science solutions and evaluating the results involve thinking carefully about the context in which they will be used.
- It's not about the technologies. Technology will always change very fast. Learn the concepts, apply them with technology. Be open to learning new technologies (and sometimes it will also imply learning new concepts). The only constant is change.

Program for this week

Intro to data science

We have just completed this part.

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The environment

Setting up the environment

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Intro to Git, and the importance of sharing our source code

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Getting familiar with the command line

Many times the shell command line is enough to answer to a lot of questions