Introduction to Final Projects

Fundamental of Data Science
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Assignments and final project

- Calendar
  - Assignment 1: 23 sept - 20 oct (4 weeks)
  - Assignment 2: 21 oct – 1 dec (4 weeks)
  - Final Project: 25 nov – 26 dec (4 weeks)

Logistics

- Start date: 25 Nov
  - ***Now***, collect ideas!

- First presentation: 6 Dec
  - 3 mins incl Q&A, 3 slides: task / setup definition
- Second presentations: 16 Dec
  - 3 mins + 2 min Q&A: Progress and presentation evaluation
- Written report submitted by 26 Dec
  - Report evaluation

- *Reports to indicate role of each member in the work*

Suggestion for First-Presentation Slides

- Slide 1 – Task and motivation
  - Task statement and definitions
  - Motivation
  - Related work
- Slide 2 – Models, tools
  - Tentative material and methods
    - From coursework, open source and research code
  - Investigation
    - Feature, model, etc.
- Slide 3 – Analysis
  - Benchmark
    - Evaluation dataset and metric

Final Projects
Topic and development

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Project Types

- Application project
  - Pick an application that is of interest to you
  - Explore how to apply learning algorithms to solve it implementing your own solution
  - Focus is not on the best results but on the *deep* understanding of how to set up and solve a machine learning problem
- Analytical project
  - Choose one or more existing projects/algorithms on a topic which you like
  - Reproduce their results
    - Using their code is fine, but cite the source -- see my note on plagiarism
  - Analyze the approach and the results
    - If you leveraged existing source code, then conduct ablation studies, propose modifications and evaluate how these affect the results

Plagiarism

- Watch out for plagiarism
  - Plagiarism is severely prohibited and would invalidate your project
  - Leveraging resources is fine, BUT acknowledge the source
  - Specify your contribution in detail

Project goal

- Choose a machine learning and/or computer vision application
  - For example well known problems from kaggle, literature, ...
- Choose a dataset (i.e. an existing.. acquiring one is lots of efforts)
  - From Kaggle
  - From some other online resource
  - E.g.
    - https://www.visualdata.io/
    - https://github.com/caesar0301/awesome-public-datasets
    - https://datasetsearch.research.google.com/
- Choose a task
  - Regression, classification, density estimation, clustering, …
- Apply methods to the task, present the analysis of your results
  - Analyze an existing project
  - Modify an existing project
  - Implement from scratch your solutions

Project goal suggestions

- Have each team member sketch 20 ideas before meeting
- Filter out list by doing quick Google searches
  - There may be an existing GitHub for your idea (ok to leverage it, but cite it)
- Pay attention to how long the training takes and how much data the models require
- Ask yourselves: are there little tweaks and/or experiments that haven't been done yet?
- Can you extend the idea e.g. to a new application?
- Which of your initial ideas makes the best story to tell?
- Which of those lets you obtain best illustrative pictures?

Gather information on your idea

- You can find information on blogs, papers, journals, Github repos, websites that summarize or explain papers, ...
- If you consider papers
  - Don’t read all of them (at least at the beginning)
  - Look at the figures and captions before anything
  - First pass reading order
    - Abstract
    - Methods
    - Results
    - Conclusion
- You need to find something interesting about the chosen topic, not to review the entire literature

Try to avoid this scenario

- Reproduce a source without your contribution (nor comments, nor analysis)
- Team starts late. Just instance and draft of code up by milestone
- Didn’t hyperparameter search much
- A few standard graphs: loss curves, accuracy chart, simple architecture graphics
- Your report is not clear. As a data scientist, illustrating your ideas, solutions and analysis is part of project
- Conclusion doesn’t have much to say about the task besides that it didn’t work

Aim for this

- Workflow set-up configured ASAP
- Have running code
- Have a benchmark to compare your results to
- Creative hypothesis is being tested
- Mixing knowledge from different aspects in ML
- Have a meaningful graphic (pretty or info rich)
- Conclusion and Results teach me something
- ++interactive demo
- ++novel / impressive engineering feat
- ++good results

Choose a method

- A method discussed in class
  - E.g. digital image processing algorithm, linear regression, optimization via gradient descent or Newton's method, logistic regression, Gaussian discriminant analysis, Naïve Bayes, SVM, ML analysis via bias/variance, Neural Networks, clustering, dimensionality reduction
- Explore other methods
- Ask us ;)

Choose a task

- Classification
  - https://www.kaggle.com/c/titanic
  - https://www.kaggle.com/c/digit-recognizer
  - https://www.kaggle.com/c/nlp-getting-started
  - https://www.kaggle.com/c/word2vec-nlp-tutorial/overview/part-1-for-beginners-bag-of-words
  - https://www.kaggle.com/zalando-research/fashionmnist
  - https://www.kaggle.com/c/kobe-bryant-shot-selection/data
  - https://www.kaggle.com/kazanova/sentiment140

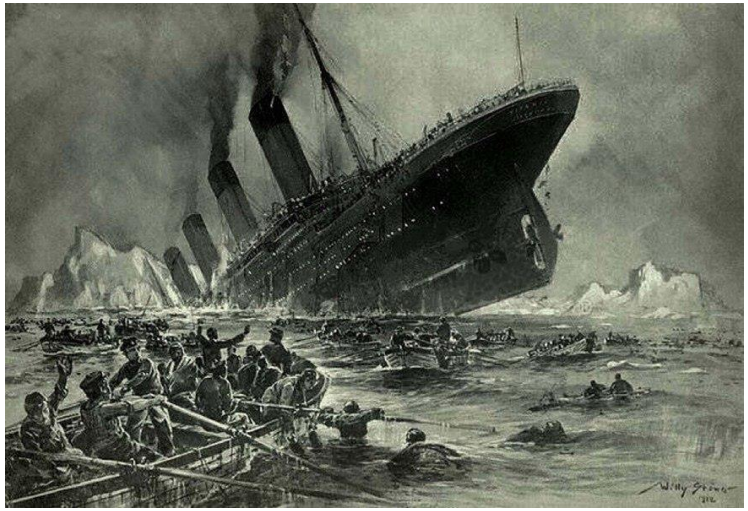
- Regression
  - https://www.kaggle.com/c/house-prices-advanced-regression-techniques
  - https://www.kaggle.com/c/restaurant-revenue-prediction/overview/evaluation
  - https://www.kaggle.com/c/how-much-did-it-rain-ii/data
  - https://www.kaggle.com/c/walmart-recruiting-sales-in-stormy-weather/overview
  - https://www.kaggle.com/mirichoi0218/insurance

Choose a dataset

- Pick one from the online lists of datasets
  - https://github.com/caesar0301/awesome-public-datasets
  - https://www.visualdata.io/
  - http://homepages.inf.ed.ac.uk/rbf/CVonline/Imagedbase.htm
  - https://www.ind-dataset.com/
  - https://github.com/renmengye/few-shot-ssl-public
  - http://www.cvpapers.com/datasets.html
  - http://riemenschneider.hayko.at/vision/dataset/
  - http://homepages.inf.ed.ac.uk/rbf/CVonline/Imagedbase.htm
  - https://www.kaggle.com/datasets
- Or find one of your choice

Example tasks

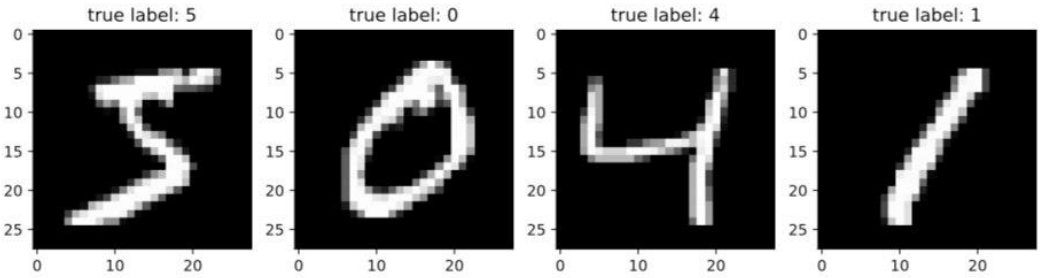
- Titanic survivors, a binary classification with ML
  - https://www.kaggle.com/c/titanic
- Predict whether a person survived or not looking at some personal information
  - 12 features representing the age, gender, ticket cost, …



PassengerId	Survived	Pclass	Name	Sex
1	0	3	Braund, Mr. Owen Harris	male
2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Thayer)	female
3	1	3	Heikkinen, Miss. Laina	female
4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female
5	0	3	Allen, Mr. William Henry	male
6	0	3	Moran, Mr. James	male
7	0	1	McCarthy, Mr.	male

Example datasets

- Digit Recognition
  - Recognize the digit from handwritten digit images
  - Multi-class classification problem (balanced)
  - 28x28 images



Example datasets

- House Pricing
  - Predict the cost of a house from information about its architecture, type of suburbs, square meters, ...
  - Regression problem
  - Prepare the data for your model, tackle missing values and categorical features

Id	MSSubClass	MSZoning	LotFrontage
1 – 1460	20 – 190	RL 79% RM 15% Other (91) 6%	NA 18% 60 10% Other (1058) 72%
1	60	RL	65
2	20	RL	80
3	60	RL	68
4	70	RL	60
5	60	RL	84
6	50	RL	85

Project presentation goals

- Have code up and running
- Data source explained correctly
  - Give the true train/test/val split
  - Number training examples
  - Where you got the data
- What Github repo, or other code you're considering
- Ran baseline model have results
  - Points off for no model running, no results
- Data pipeline is in place and explained clearly
- Discussion of results, including surprising findings
- Reasonable literature review (3+ sources)

Project report

- 1-2 page progress report. Not super formal
- Suggested sections
  - Title
  - Abstract
  - Introduction
  - Related work
  - Proposed method explained
  - Dataset and Benchmark
  - Experimental results
  - Conclusions and Future work
  - References

For a good project report

- 5 W's
  - What? (a problem)
  - Why? (motivation)
  - How? (proposed strategy)
  - Where? (dataset and benchmark)
  - Who? (team assignments)

- It is desired.. your considerations on
  - Influence of parameter and method choice
  - Results: what is expected and what is surprising.. not just numbers!

- Observations must be substantiated by results or references

Questions?

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