PROGRAMMING IN PYTHON II

Project Design and Outline

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MOTIVATION

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- Spoiler alert: The choice of the ML method itself is only one aspect of many

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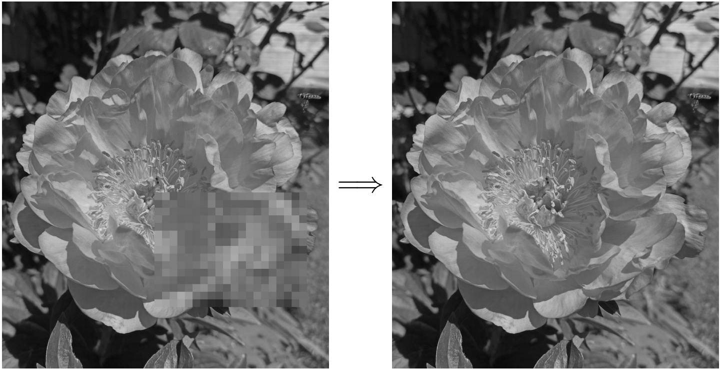
- We will cover the details during the semester
- We will use our ML project as example



OVERVIEW

Project Design

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  5. How to **evaluate** the methods/models?
- **There is no one-fits-all solution!** Specific tasks require specific considerations!

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- **Do not** make simplifications here! Make sure you are aware of the real (end) goal and communicate this!
- Rinse and repeat to overcome language barriers

DATA

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  - Best case but rather rare (our hunger for data is only limited by computational restrictions!)
- Sometimes the goals will follow from existing but insufficiently large data
  - Common case
  - Has influence on choice of ML method
  - Allows for educated guesses at sufficiently large data size
  - Can be a starting point for collecting more data

Data (2)

- Sometimes the goals are not backed up by any data
  - Very tricky and potentially dangerous!
  - You would have to make guesses about how much and which data would be needed
  - You would have to make guesses about the ML method performance in advance
  - You will need to interface with the data collection process (first get small dataset, then collect more)
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- A dataset might be unsuitable for your purposes
  - Biases, artifacts, labeling errors, . . .

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  - Perform data preprocessing and augmentation
    - Normalization, oversampling, cross-validation splits, data augmentation, . . .

HARDWARE/SOFTWARE

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- CPU, GPU or TPU based?
- Size of RAM and disk storage?
- Hardware compatible with ML software? Software restrictions from company/collaborations?
- Short-term or long-term project?
  - Rent or own? Little compute over long time or lots of compute over short term?
  - Possible start: First design/implement/experiment on owned hardware, then perform final tuning on rented hardware if needed

ML METHODS

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- You will need a theoretical understanding of the methods to judge which ones to consider
  - Literature research
  - Later semesters of AI study
- Start with baselines/less complex methods and models
  - Statistics, logistic regression, SVM, Random Forest, ...
  - Check Supervised Learning before Reinforcement Learning and Unsupervised Learning

EVALUATION

Evaluation

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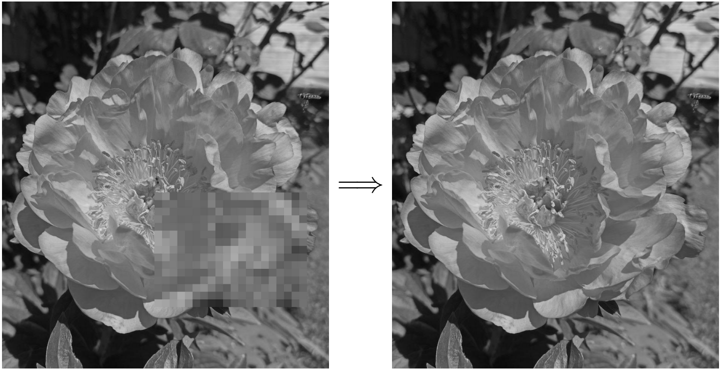
- Which score/performance measure?
- Do you need to correct for biases?
- Which aspects of the goal are more important?
- What do you want to generalize to?

PYTHON II PROJECT

Python II Project: Goal (1)



Python II Project: Goal (2)

- Image Depixelation (recreation of pixelated area within an image)
- End goal: Best score on challenge server leaderboard
  - Pixelated image is fed into model, and model predicts plausible values for the pixelated area
  - Size of the pixelated area and pixelation block size should be freely selectable
  - Images should be grayscale images

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- What is “plausible”?
  - Luckily, the challenge server decides for us: “Plausibility” is measured by the root-mean-squared error (RMSE) of the predicted pixels

Python II Project: Data (1)

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- We will have the following data:
  - JPEG images up to 250kB
  - 100 images per student
  - Assumption: We collect roughly 30k valid images

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- We will have to
  - Clean up the raw data (exclude invalid files)
  - Perform analysis and preprocessing
  - (Possibly) perform data augmentation

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  - Python $\geq$ 3.9
  - PyTorch
- Methods:
  - Simple **Convolutional Neural Network (CNN)**
  - You may also use other NN types/more complex settings
  - Design and fine-tuning is up to you

Python II Project: Evaluation

- Challenge server score determines the evaluation method
- Will use the root-mean-squared error (RMSE) of the predicted pixels