Analyzing Software using Deep Learning

Lecture 5:
Introduction to Course Project

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Plan for Today (Part 2)

Introduction of course project

- **Goal**
- **Training data**
- **Framework**
- **Tasks**

Goal

- **Code completion**
- **Two phases**
  - Learn from corpus of programs
  - Respond to queries
- **Query = Program with a missing part**

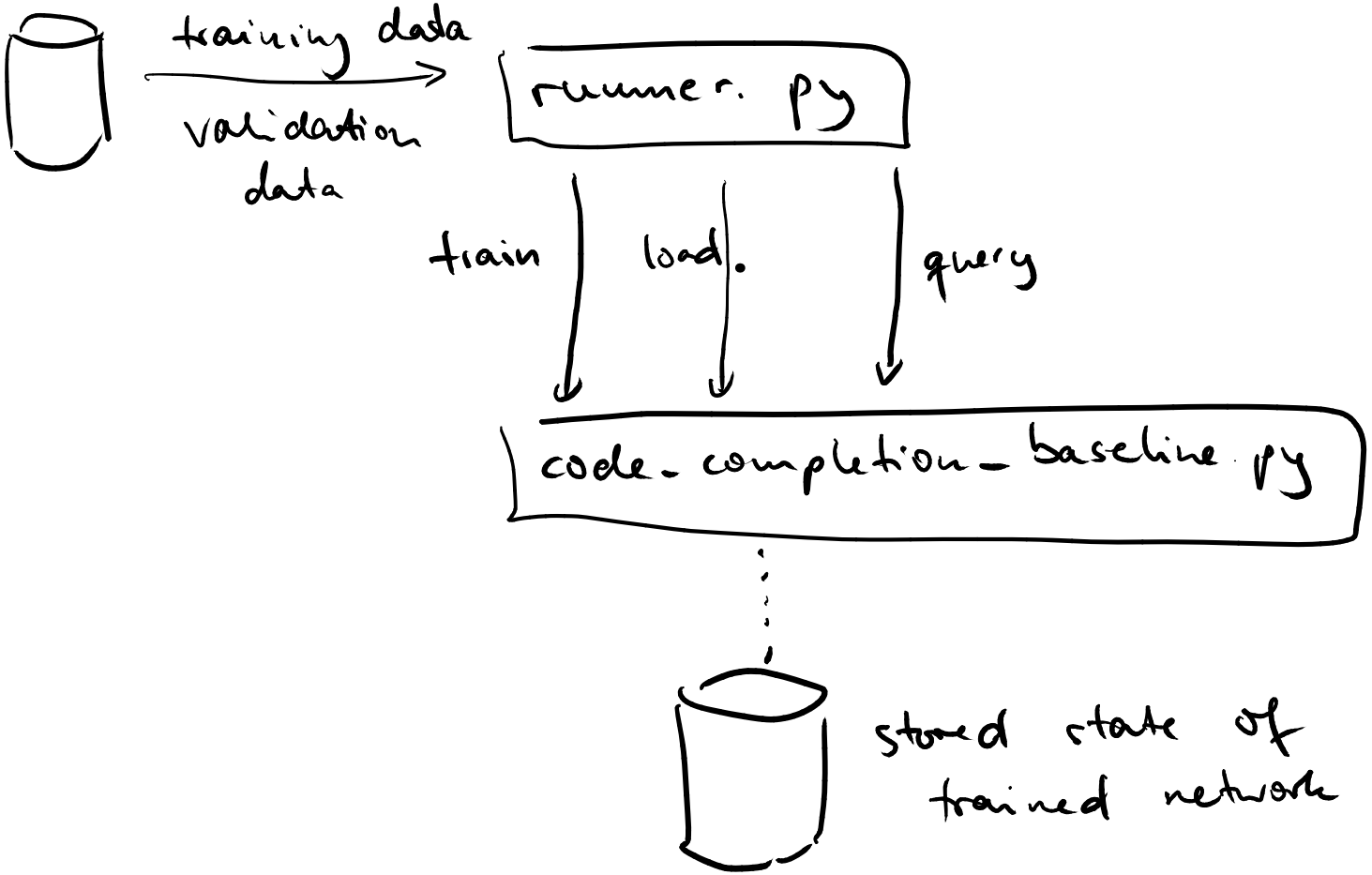
Training Data

- 1,000 JavaScript programs
  (relatively small data set)
- Representations
  - Sequences of tokens (default)
  - Abstract syntax trees (optional)
- Using the training data
  - During development and for empirical results:
    Use subset for training and other subset for validation
  - For submission of trained network:
    Train will all examples

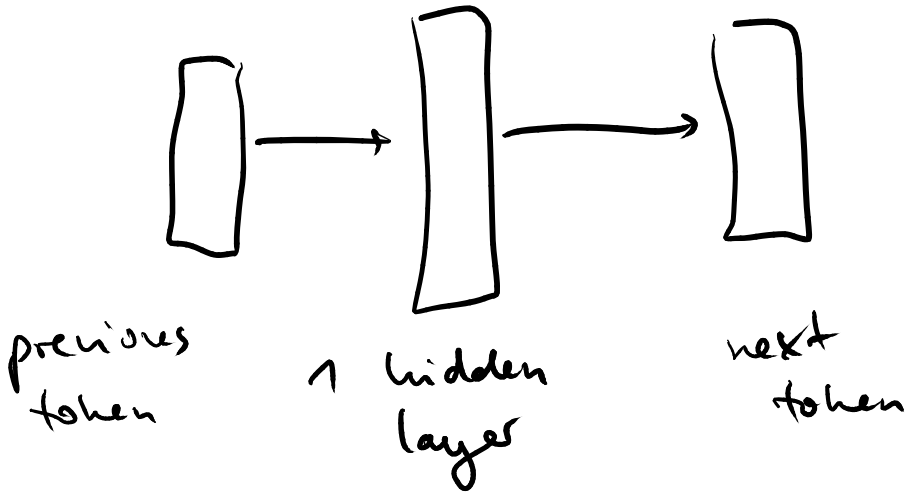
Framework

https://github.com/michaelpradel/ASDL2017

Framework: Overview



Baseline Implementation



Token:
- type
  ↳ e.g., punctuator
- value
  ↳ e.g., "("

→ combine into string
↳ "punctuator-@@-("

→ one-hot encoding

Example: $\underbrace{\text{var x}}_{\text{prefix}} \underset{\text{expected}}{=} \underbrace{23;}_{\text{suffix}}$ → Training data: ("x", "=")

Accuracy

Measure of success:

$$accuracy = \frac{nb.\ of\ \ correct\ predictions}{total\ nb.\ of\ \ queries}$$

Baseline implementation:

0-5% accuracy (i.e., pretty bad)

Improving Accuracy

- **Anything that improves accuracy is in scope**
- **Some ideas to start with**
  - Use more hidden layers
  - Try other neural network architectures
  - Try another representation of tokens
  - Vary the hyperparameters (size of hidden layers, batch size, etc.)
  - Predict more than one token
  - Use prefix and suffix of missing tokens

Optional Tasks

Possible extra points

- Predict type and value of tokens individually
- Consider full tokens (i.e., do not abstract away identifier names, etc.)
- Use tree representation of programs

Deliverables

- **Project report**
  - Describe and discuss your approach
  - Describe and interpret empirical results
- **Implementation**
  - Must be executable and documented
- **Trained neural network**
  - We will query it with additional programs

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Strict deadline: July 27, 2017 (midnight, Darmstadt time)