Writing Style Change Detection on Multi-Author Documents

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Rhia Singh
rhia.singh@macaulay.cuny.edu

Janith Weerasinghe
janith@nyu.edu

Rachel Greenstadt
greenstadt@nyu.edu

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Overview of the Approach

- Use Authorship Verification for Style Change Detection

- Authorship Verification:
  - Given two documents, predict if they were written by the same person
  - PAN 2020 Results: 0.953 AUC, 0.891 F1-Score
  - PAN 2021 Results: 0.972 AUC, 0.926 F1-Score
  - ~ 275k document pairs, ~4.8k tokens per document

- Style Change Detection:
  - ~ 11k training records
  - ~ 52 tokens per paragraph

Authorship Verification Approach
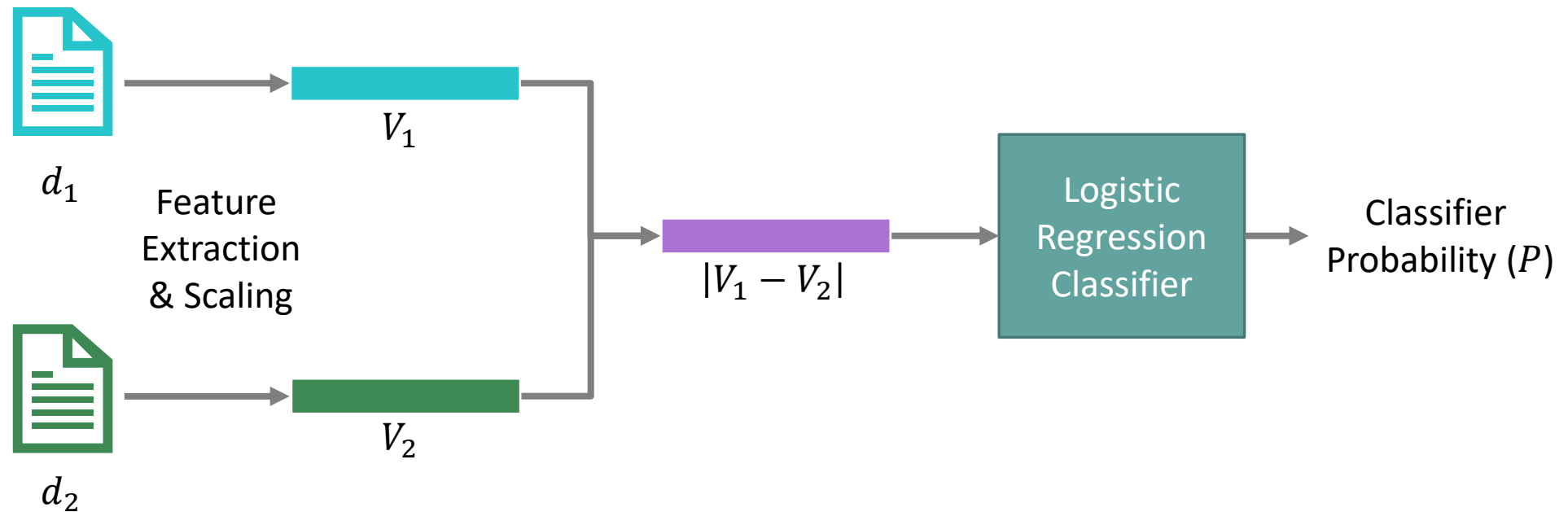
Style Change Predicting
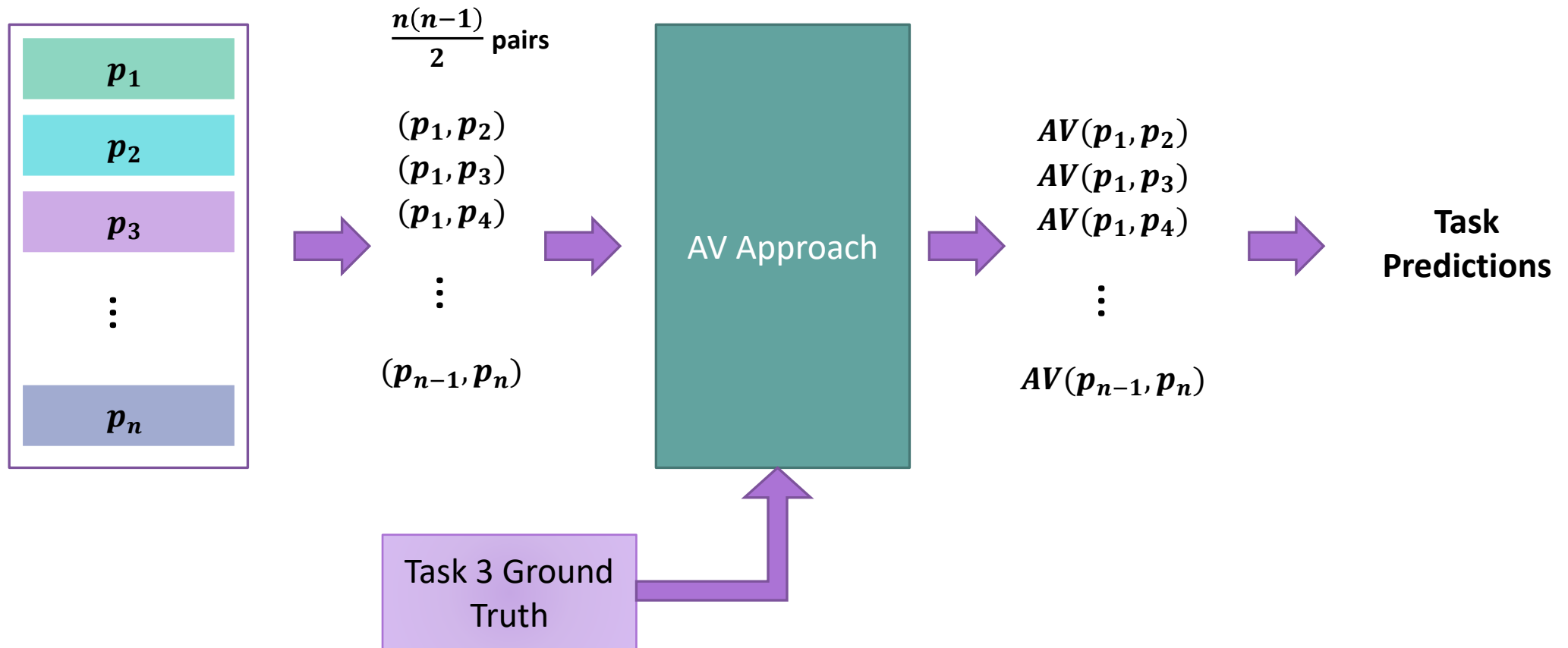
Features

- Character tri-grams (TF – IDF)

- Special Characters (TF – IDF)

- Frequency of Function Words

- Average number of characters per word

- Distribution of word-lengths (1-10)

- Vocabulary Richness measures*

- Unique Spellings (fraction of tokens)*
  - Commonly misspelled words, British spelling of words, and popular online abbreviations

* Included after early submission

Features

Example:
```
There should be some setting file to edit
manually I guess.
```

POS Tags:
```
[('There', 'EX'), ('should', 'MD'), ('be', 'VB'),
('some', 'DT'),('setting', 'VBG'), ('file', 'NN'),
('to', 'TO'), ('edit', 'VB'), ('manually', 'RB'),
('I', 'PRP'), ('guess', 'VBP'), ('.', '.')]
```

Parse Tree:
```
(S
  (NP There/EX)
  (VP should/MD be/VB)
  (NP some/DT setting/VBG file/NN)
  (VP to/TO edit/VB)
  manually/RB
  (NP I/PRP)
  (VP guess/VBP)
  ./.
)
```

- POS-Tag tri-grams (TF − IDF)

- POS-Tag Chunk tri-grams (TF − IDF) :
  - `[NP, VP, NP, VP, RB, NP, VP, .]`

- POS Tag chunk construction (TF − IDF) :
  - `[NP[EX], VP[MD VB], NP[DT VBG NN], VP[TO VB], NP[PRP], VP[VBP]]`

- Function-word and POS tag hybrid tri-grams*:
  - `[There should be some VBG NN to VB RB I VBP .]`

- POS tag ratios*

* Included after early submission

Task 1: Single vs. Multiple

- Predict: Whether the text is written by a single author or by multiple authors

- If mean AV score of adjacent paragraphs $> 0.5 \Rightarrow$ Multi-Author

$$\frac{\sum_{i=1}^{n-1} AV(p_i, p_{i+1})}{n-1} > 0.5$$

Task 2: Style Change Basic

- Find the position of style changes

- If AV score for two adjacent paragraphs $> 0.5 \Rightarrow$ style change

- $AV(p_i, p_{i+1}) > 0.5 \qquad \forall i \in [1, n-1]$

Task 3: Style Change Real-World

- Uniquely identify each author (max 4 authors)

- Use hierarchical clustering to cluster authors with similar writing style

- Use a threshold of 0.5

- If > 4 clusters, set max_clust=4
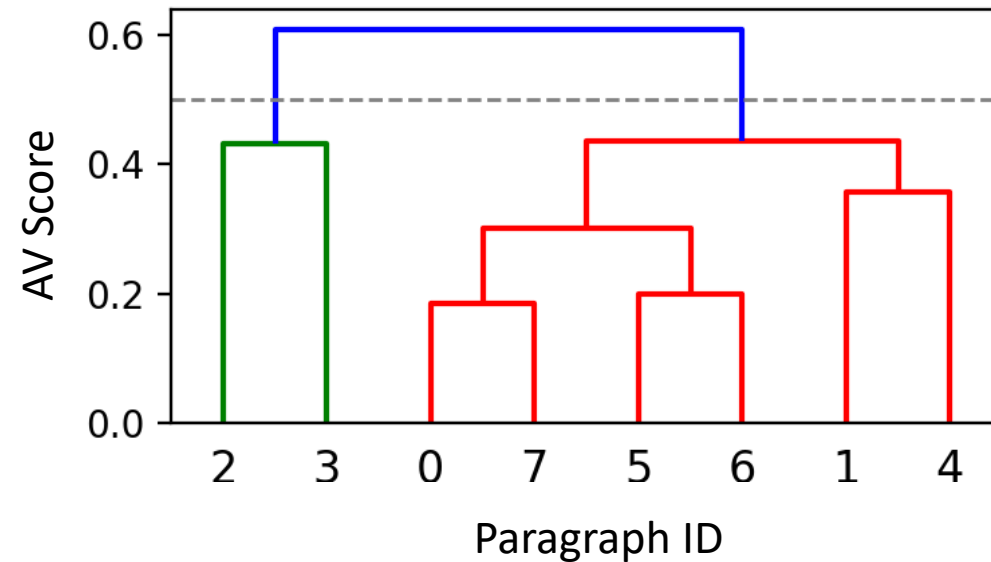
Results

Description	Task 1	Task 2	Task 3
Early Submission	0.622	0.640	0.326
Local Validation Set	0.649	0.644	0.428
Final Evaluation	**0.634**	**0.657**	**0.432**

Thank You!

Questions:

Rhia Singh: rhia.singh@macaulay.cuny.edu
Janith Weerasinghe: janith@nyu.edu

Source Code and Models:

https://github.com/rhiats/style_change_detection_pan2021