Trade-offs in computational sociolinguistics methods

Accuracy vs. fairness in forced alignment-based auto-coding

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Forced alignment-based auto-coding

doesn't seem to work too good for coronal stop deletion 🤷

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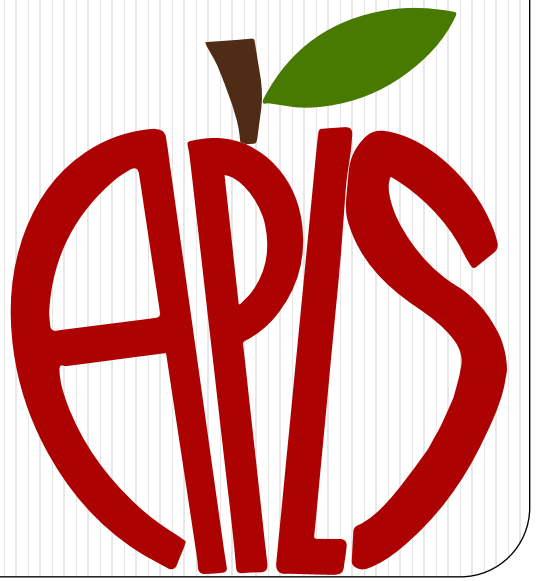
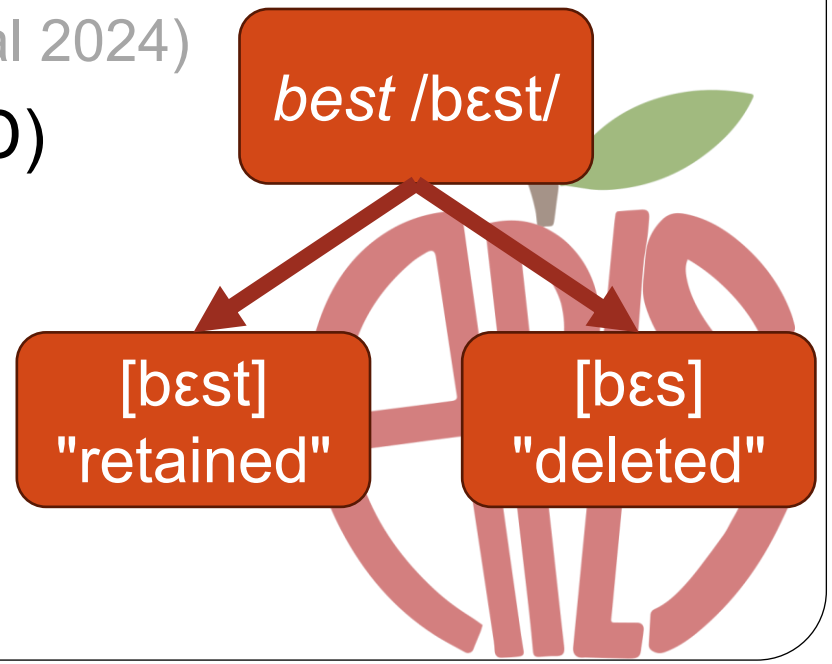


Sociolinguistic auto-coding (SLAC)

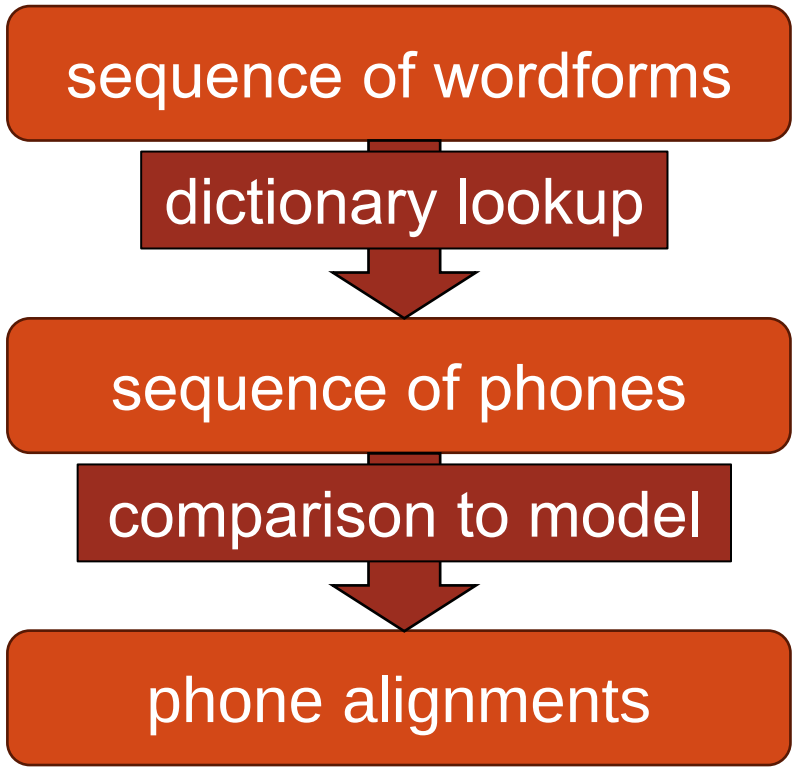
- SLAC: machine learning for labeling tokens with variants (Bailey 2016; McLarty et al. 2019; Villarreal et al. 2020; Kendall et al. 2021)
- But questions remain:
  - How to implement it
  - Whether it's meant to replicate human coding
  - How to account for intergroup fairness (Villarreal 2024)
- Today: SLAC with coronal stop deletion (CSD)



SLAC via forced-alignment

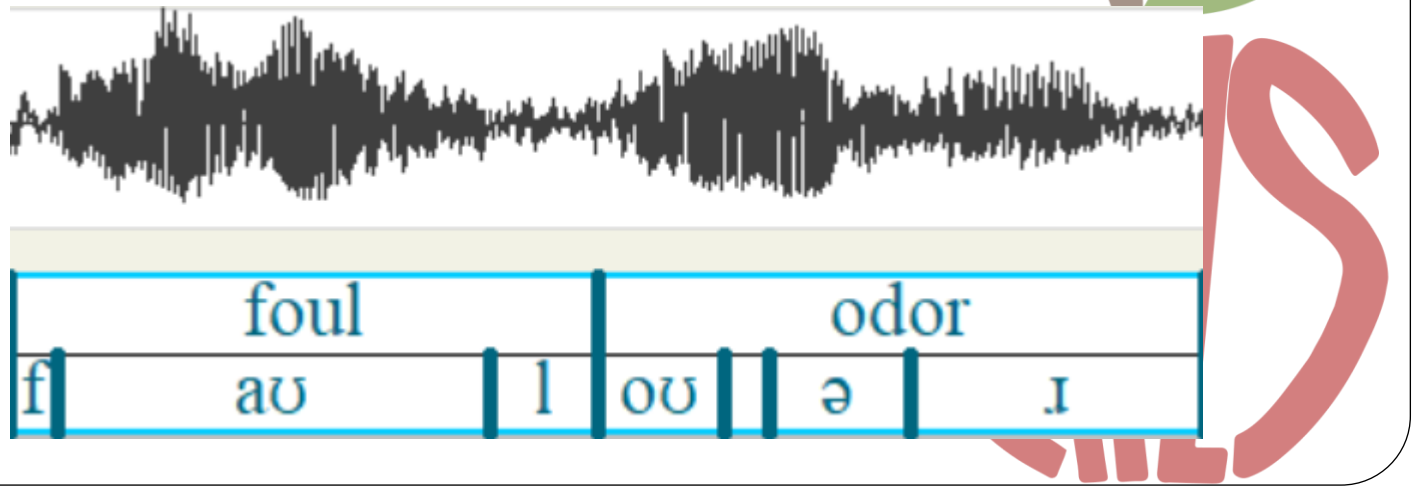
(Bailey 2016; Kendall et al. 2021)

- Exploits forced-aligners' ability to consider multiple candidate phonological representations for the same lexical item



`foul odor`

`faʊl oʊdəɹ`



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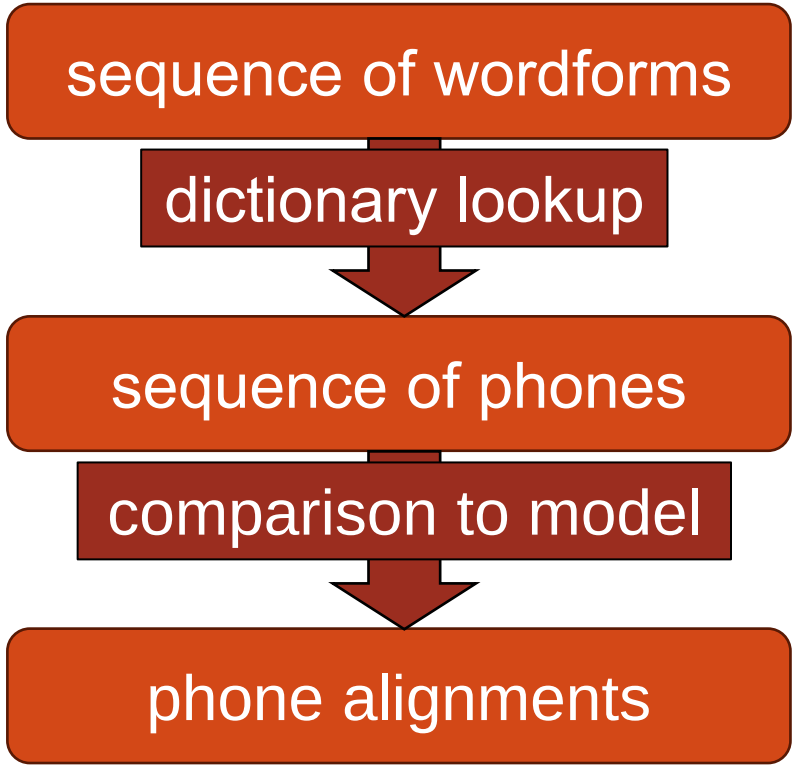

the odor

(ði|ðə) oʊdəɹ

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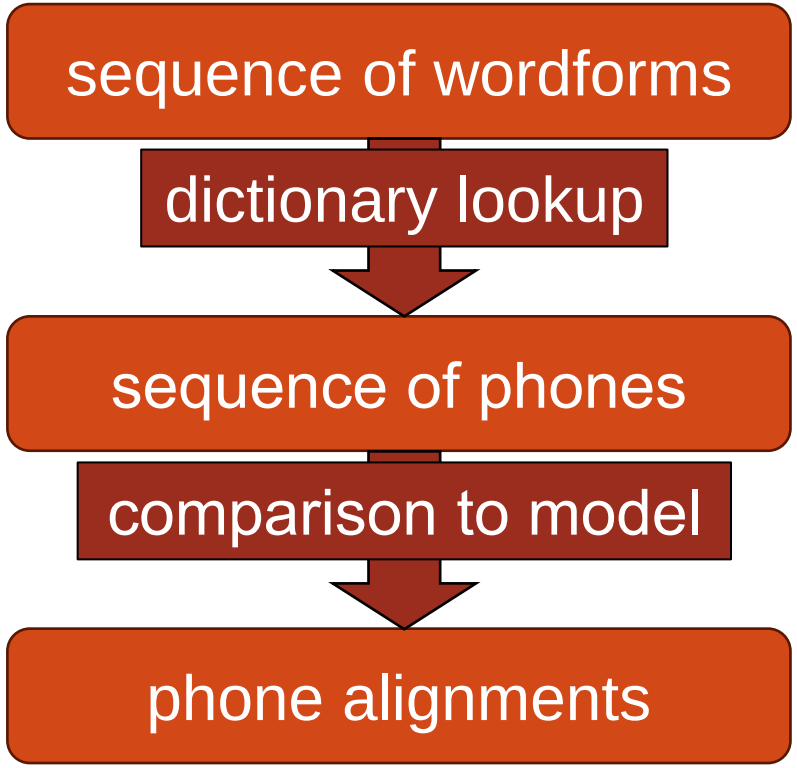


best odor

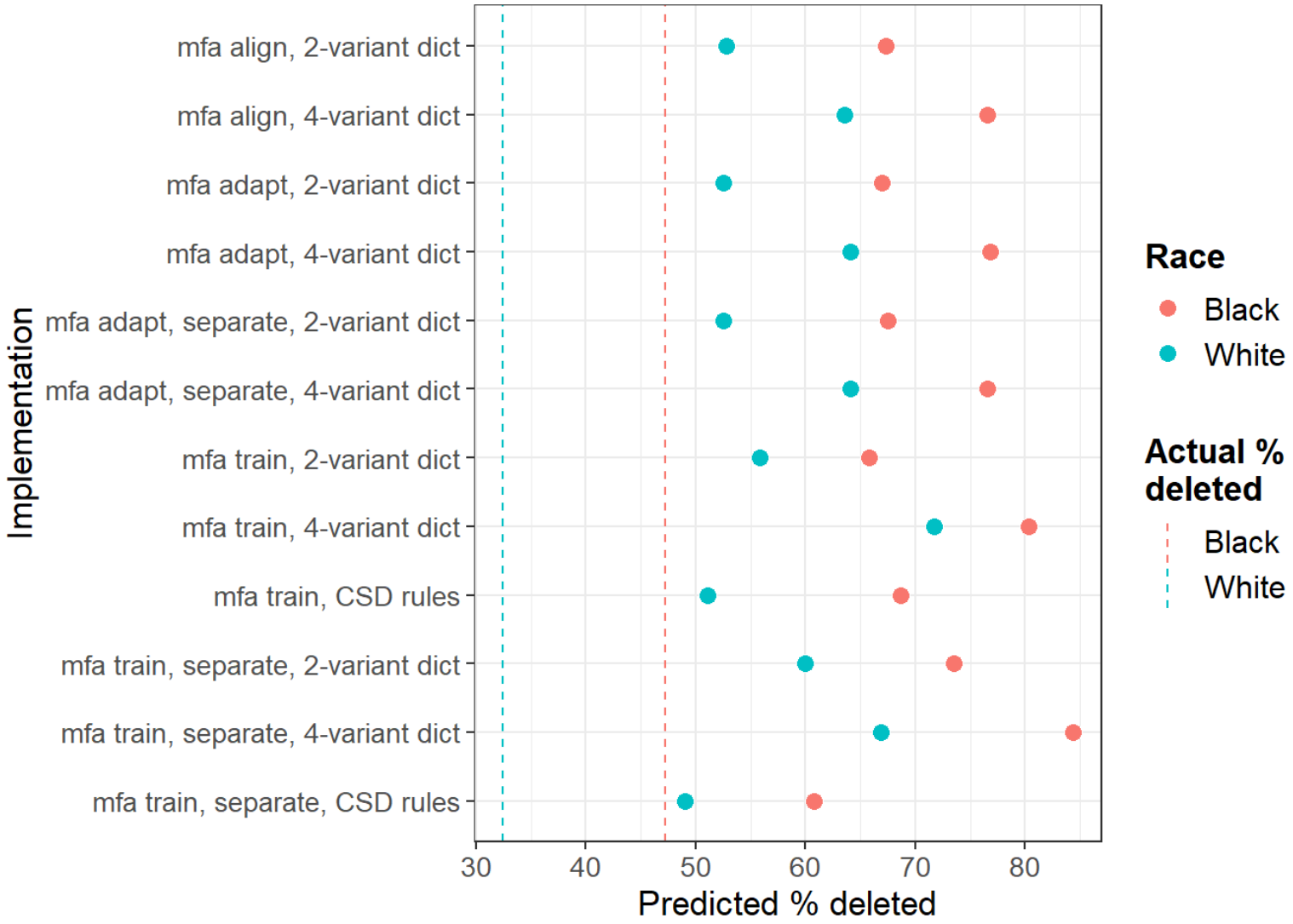
(bɛ**st**|bɛ**s**) oʊdəɹ

Data & models

- 10,199 CSD tokens from Black & White speakers in Pittsburgh
  - 1005 hand-coded as retained (incl. [ɾ ʔ]) or deleted
  - Black speakers: 47% deleted (240/508). White: 32% (161/497)
- Entire corpus (33 hours) aligned with Montreal Forced Aligner version 3.1.0 (McAuliffe et al. 2017), in 12 implementations (models):
  - Workflow: align with off-the-shelf `english_mfa` model, adapt `english_mfa`, train-and-align
  - Strategy: 2-variant dictionary, 4-variant dictionary (w/ [ɾ ʔ]), phono rules
  - Dataset for train-and-align: corpus all at once vs. race-separate
- Output word alignments checked for final [t d (ɾ ʔ)]

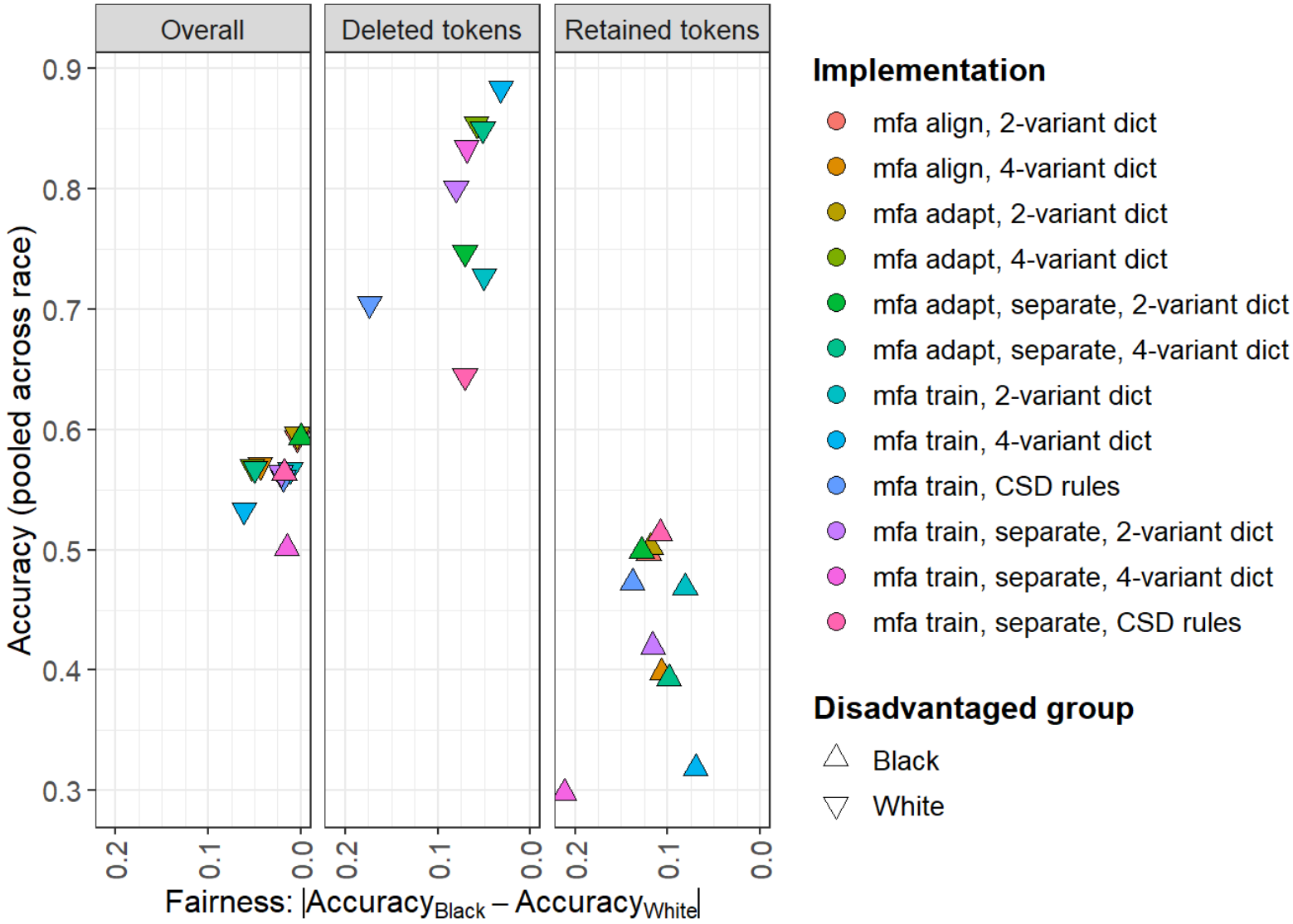
Predictions for hand-coded data (*n* = 1005)

- All models **over-**predicted deletion
- 9/12 **under-**predicted magnitude of race effect on deletion
  - Range of predicted diffs: 8.7–17.6pp
- Difficulty of detecting [t̄ tˀ ɾ ʔ]?



Accuracy

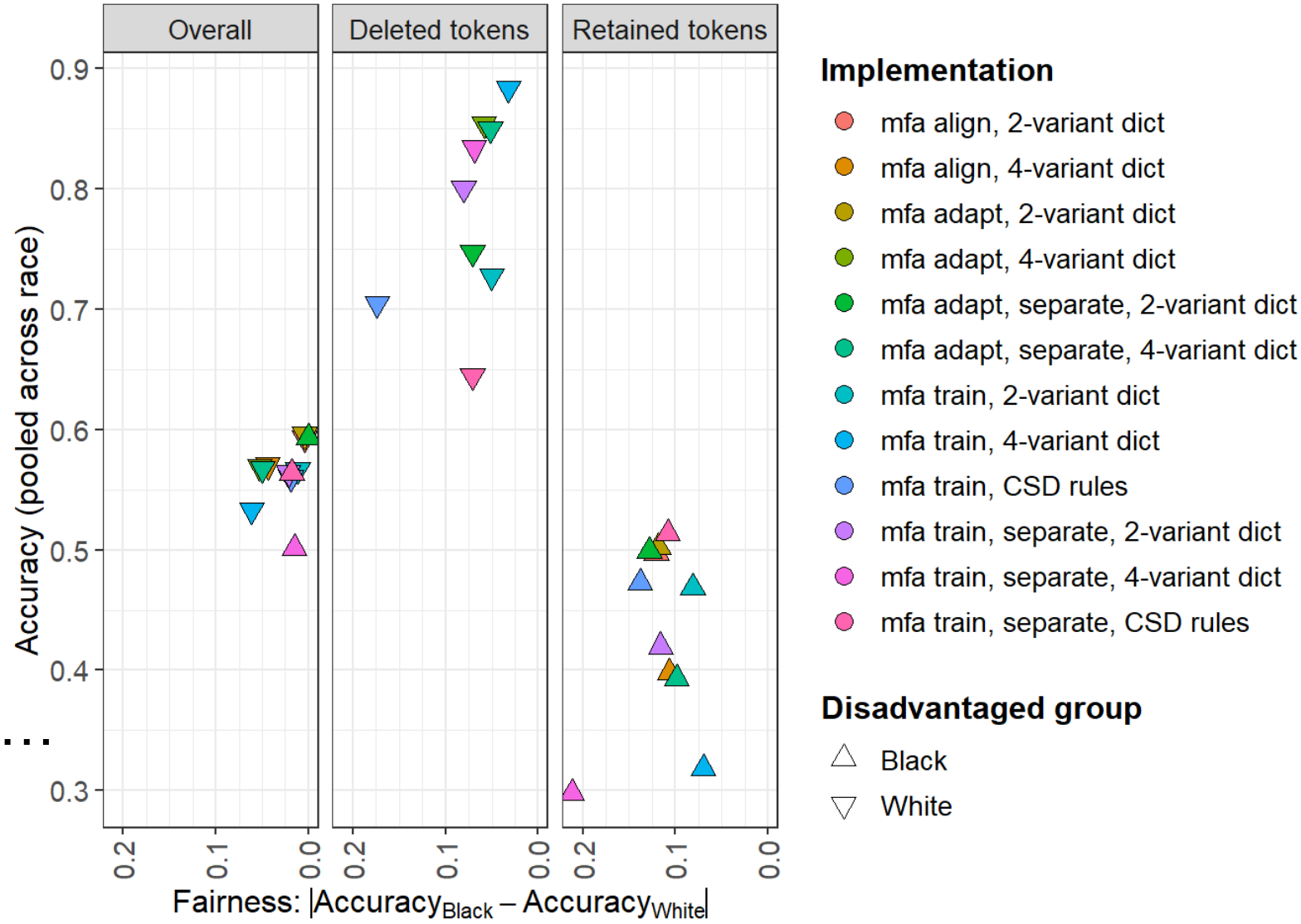
- SOTA: ~85%
- Here: 50.1–59.6%
  - Worse for train-and-align
- Better accuracy for (actual) deleted than retained
  - Because deleted over-predicted



Fairness

- $|Acc_{Black} - Acc_{White}|$
- Overall: 0.02–6pp
- Among deleted tokens: 3–17pp
  - Worse for White
- Among retained tokens: 7–21pp
  - Worse for Black

- Hence my takeaway…



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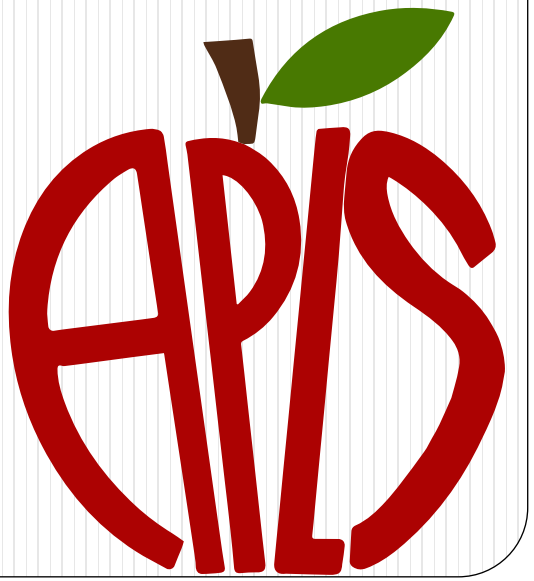
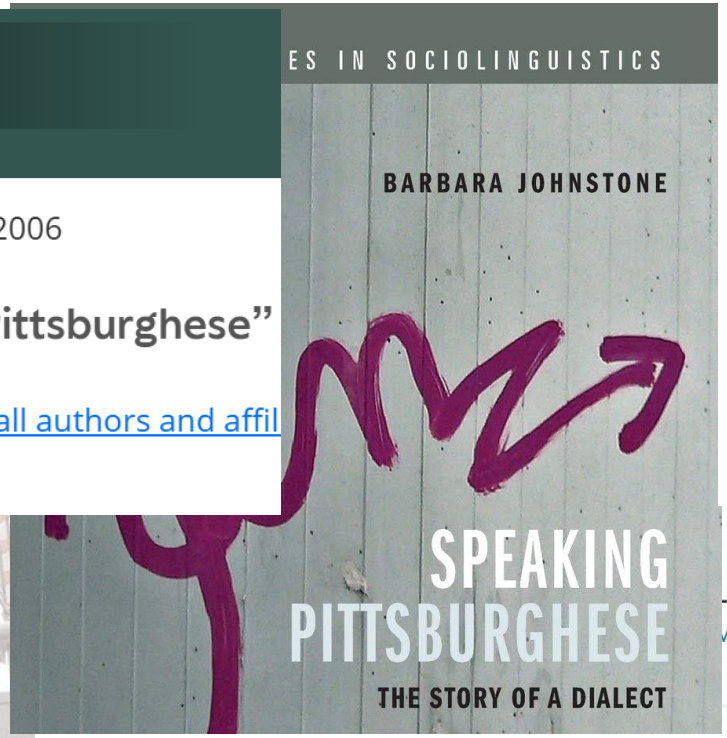
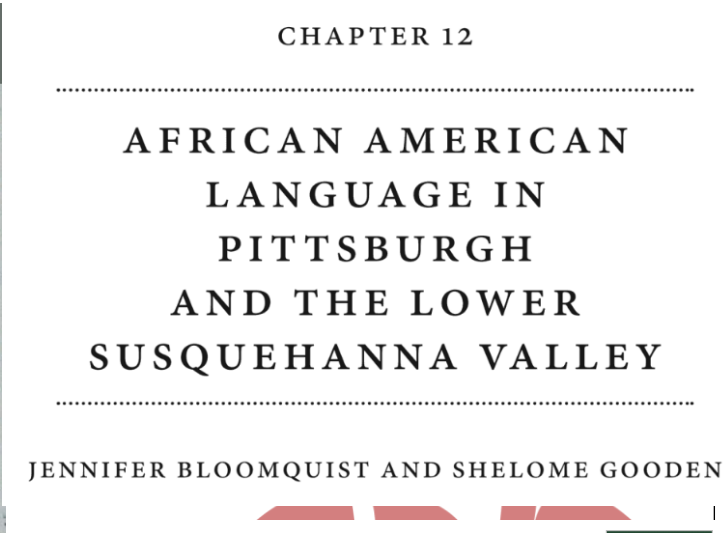
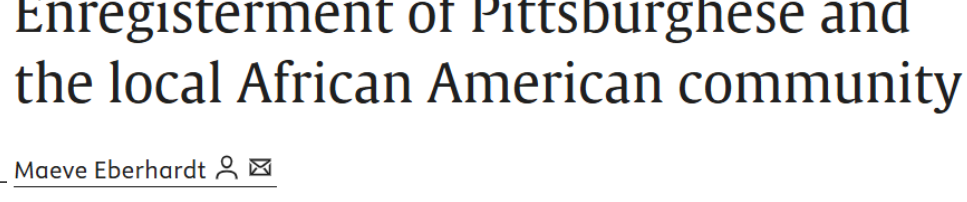


Introducing APLS

- The Archive of Pittsburgh Language and Speech (APLS): a soon-to-be publicly accessible corpus of Pittsburgh socioLx interviews







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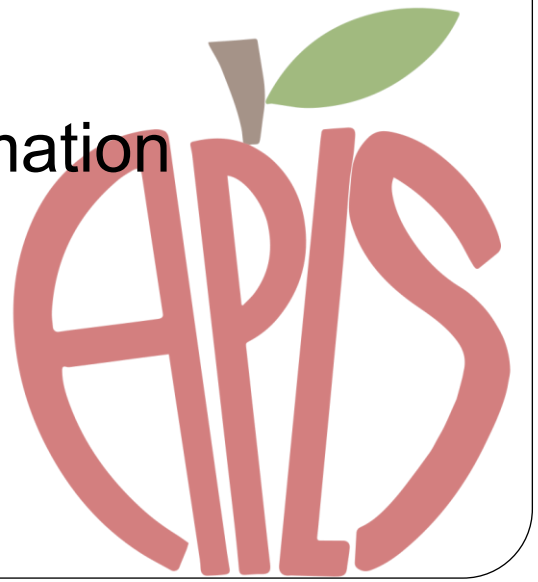
- Powered by LaBB-CAT corpus management framework (Fromont & Hay 2012)
- Currently: 33 hours of speech from 34 interviewees
  - 387K word tokens, 956K aligned segments
  - When complete: 45 hours from 40 interviewees
- Richly annotated with multiple layers of linguistic information
- Example: searching CSD tokens for speaker "HD06"



Thanks! Questions?

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