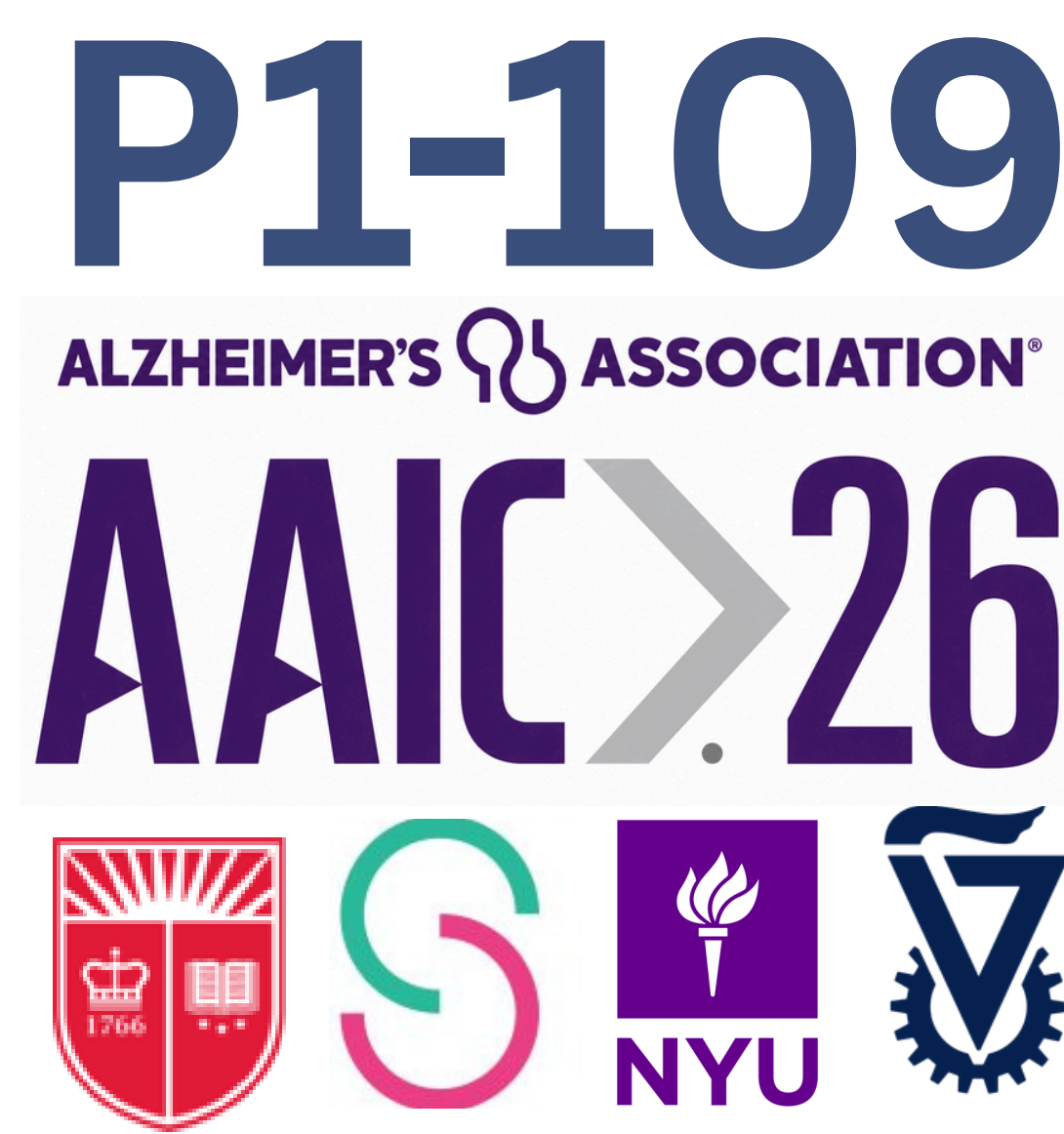


Language Alterations in Asymptomatic Middle-Aged Adults Across APOE Genotype and Amyloid Burden Groups

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Background

- **Language** may capture changes associated with **early AD-related processes**.
- We use **embedding-based language features** for binary classification of **APOE genotype** and **amyloid-β burden**, among the earliest indicators of AD-related pathology.
- We **compare the language-based models** with models based on **traditional cognitive measures** as baselines.

Results

IRAP Classification Performance

Task	Class	Cog F1	Lang F1
APOE4	Positive	0.257	0.275*
	Negative	0.709	0.676
	Macro Avg	0.483	0.475
SUVR Q1	Positive	0.780	0.780
	Negative	0.341	0.282
	Macro Avg	0.560	0.531
SUVR Median	Positive	0.532	0.532
	Negative	0.514	0.530*
	Macro Avg	0.523	0.531
SUVR Q4	Positive	0.186	0.209*
	Negative	0.764	0.764
	Macro Avg	0.475	0.486

Monte Carlo Cross Validation (mean over 1000 random 80/20 splits). Wilcoxon signed-rank test: ΔF1(Lang-Cog)>0. * = p < 0.05

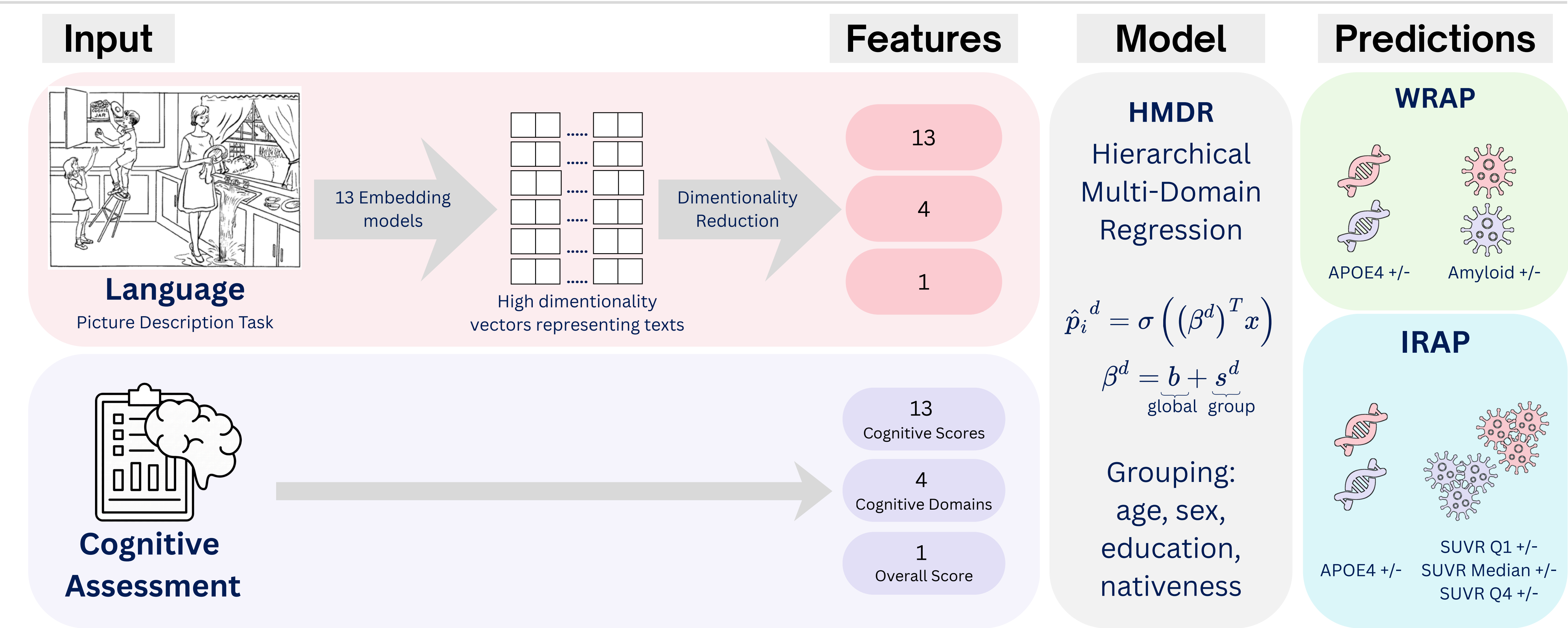
WRAP Classification Performance

Task	Class	Lang F1
APOE4	Positive	0.282
	Negative	0.722
	Macro Avg	0.502
Amyloid Burden	Positive	0.286
	Negative	0.794
	Macro Avg	0.540

5 fold Cross Validation

Methods

Participants Middle-aged asymptomatic **Hebrew** and **English** speakers with parental history of AD from **IRAP** / **WRAP** cohorts (Israeli / Wisconsin Registry of Alzheimer’s Prevention)



IRAP Model Agreement

APOE4		SUVR Q1	
Lang +	0.09	0.23	
	0.17	0.52	
	+ Cog -	+ Cog -	
SUVR Median		SUVR Q4	
Lang +	0.34	0.16	
	0.19	0.31	
	+ Cog -	+ Cog -	

Demographics

	IRAP	WRAP
N Samples (Participants)	131 (125)	1677 (534)
Female (%)	87 (62.6%)	1147 (68.4%)
Mean Age (SD)	63.8 (6.8)	64.7 (7.5)
Mean Education Years (SD)	16.1 (2.4)	16.6 (2.7)
% Native Speakers	79.1%	98.4%
% APOE4 Positive	32.1%	37%
% Amyloid Positive	-	27.2%

Takeaways

- Language outperformed cognition models for APOE4 and high amyloid burden in Hebrew speakers (IRAP).
- Language models showed strong performance in English speakers (WRAP); cognitive baselines are in progress.
- Disagreement cases suggest that language and cognition capture complementary signals.

Conclusions

Language-based approaches provide a non-invasive and scalable means of detecting changes associated with AD. Importantly, these signals may already be detectable in preclinical stages and are not fully reflected in traditional cognitive measures.

