

Non-invasive Prediction of Alzheimer's Disease Risk Using Longitudinal Retinal Fundus Images in a Community Cohort P1-001

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- Longitudinal retinal histories improve Alzheimer's risk prediction, with LongRETSurv consistently outperforming single-image models.
- This scalable, non-invasive approach could support identification of high-risk individuals and personalised dementia screening.

INTRODUCTION

Alzheimer's disease lacks scalable early detection, as biomarkers are invasive or costly. Retinal imaging is a non-invasive alternative, yet current retinal AI focuses on cross-sectional detection or post-diagnosis progression rather than longitudinal pre-diagnostic risk prediction.

METHODS

Using SCoNe (>1M retinal images, >70K patients), we developed LongRETSurv, a longitudinal Transformer-based survival model to predict time to Alzheimer's diagnosis. Matched cases and controls are shown in Fig.1 (matching strategy) and Table 1 (cohort characteristics).

RESULTS

Table 1: Alzheimer's cases and controls (1:4 matching ratio)

Category	Variable	Alzheimer	Control
Demographics	No. of individuals	1,051	3,831
	Age	79 (74-83)	80 (74-85)
	Sex, female	692 (66%)	2,498 (65%)
	Sex, male	359 (34%)	1,333 (35%)
	SIMD ¹	4 (2-7)	4 (2-7)
	Ethnic, white	965 (92%)	3,542 (92%)
Comorbidities	Ethnic, others ²	86 (8%)	289 (8%)
	Diabetes	275 (26%)	958 (25%)
	Hypertension	736 (70%)	2,688 (70%)
	Ischaemic	267 (25%)	907 (24%)
	Stroke	486 (46%)	1,733 (45%)
	otherRetina	588 (56%)	2,093 (55%)
Imaging Info	No. of image pairs	3,693	15,523
	No. of visits	2 (1-5)	2 (1-6)
	EarliestImInterval	10 (5-10)	5 (5-15)
	MedianImgsPerInterval	1.5 (1-3)	2 (1-3)
	IQRImgsPerInterval	0.5 (0-1)	0 (0-1)
	ObservedYears	3 (1-6)	4 (1-12)
	EarliestImToEvent	8 (4-11)	9 (4-15)
	LastImToEvent	3 (2-6)	3 (2-5)

RESULTS

Sensitivity was 60% and 36% at 90% and 95% specificity, comparable to plasma biomarker (P-tau217) performance (AUC 0.77–0.83 alone, ~0.90 multimodal) [1,2] and above prior retinal or multimodal models (AUC ~0.70–0.75) [3,4].

CONCLUSIONS

By modelling individual risk trajectories, this approach supports earlier identification of high-risk individuals and personalised dementia screening in routine care.

REFERENCES
scan QR code



CONTACT



See the **SCoNe** website for more information about the repository and its funders.

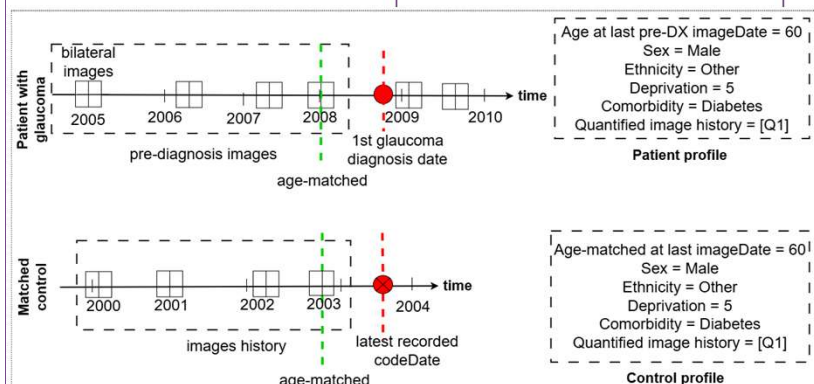


Figure 1. Schematic overview of disease-control cohort construction and matching strategy using diagnostic codes, imaging timelines, and matched healthcare records in the SCoNe repository.

Time-dependent AUCs (Fig. 2) show LongRETSurv outperforming the single-image (SingRETSurv) model across all observation times, reaching a peak AUC of 0.89 with richer longitudinal histories.

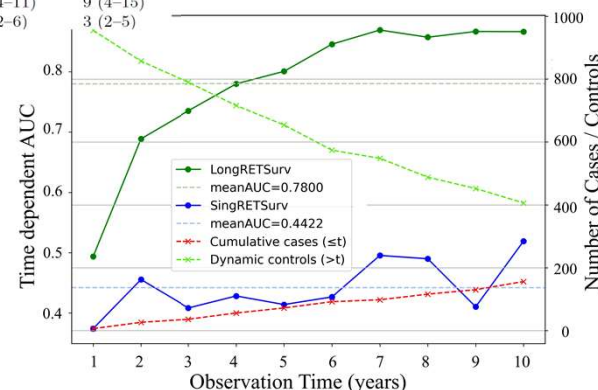


Figure 2. Dynamic AUCs for LongRETSurv and SingRETSurv over 1–10 years; LongRETSurv shows superior performance.