



INTRODUCTION

The superior performance of Deep neural networks (DNN) over decision tree-based models for predicting clinical outcomes such as time of death in intensive care units (ICU) is well known.

While decision tree-based models can rank the importance of assessed covariates per population, Tabnet can rank them per individual.¹

The ranking report can help to:

- Make trust bonds between healthcare providers and AI-based machines.²
- Improve the quality of healthcare services by considering the importance of the reported covariates.

OBJECTIVES

- We used Tabnet, a new class in DNN models proposed by Google, to predict acute kidney rejection within the first 6 months for deceased donors.
- We aimed to compare the performance of Tabnet in terms of prediction accuracy and ability to rank the observed covariates per individual and in the whole study population to that of other DNN models.

METHOD

269,136 matched deceased kidney donors between 1987 and 2022 were used from the United Network for Organ Sharing (UNOS) dataset.

The Tabnet classification model was trained by 80% and tested by 20% of patients to predict if a graft failed within 6 months post-transplant (early rejection) or afterward (late rejection).

110 different covariates were selected from both organ donors and recipients.

The covariate importance for all patients was calculated to form the rank of covariates relevant to early rejections.

The XGBoost model, a decision tree-based model, was used as the control model to compare their ability to predict classifications.

AUTHORS

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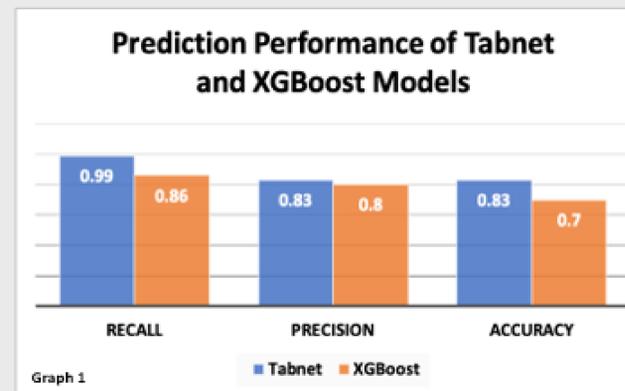
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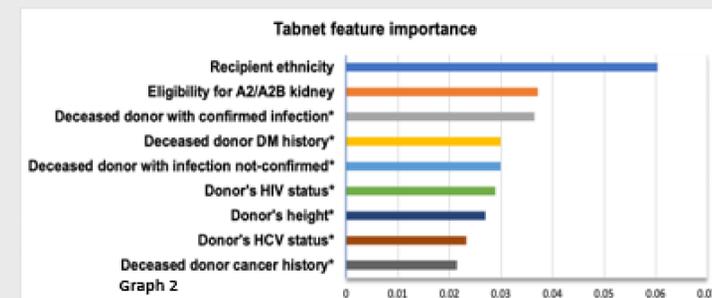
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RESULTS

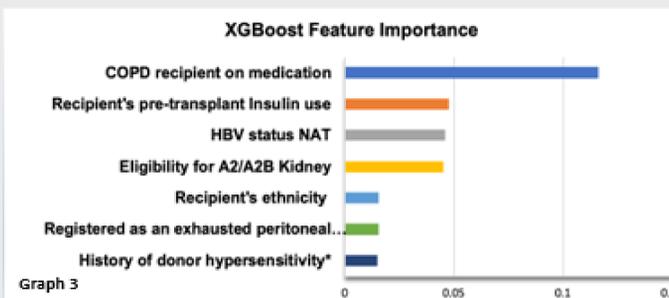
- Tabnet performance metrics: recall=0.99, precision=0.83, accuracy=0.83
- XGBoost performance metrics: recall=0.86, precision=0.80, accuracy=0.70 (Graph1)
- Tabnet model showed superior performance over the XGBoost model.
- Performance of two other famous decision-based models, LightGBM and CatBoost, was almost identical to XGBoost.



Comparing the top 30 percentile of ranked covariates, 7 out of 9 covariates identified by Tabnet are related to donors versus only 1 out of 7 covariates identified by XGBoost. (Graph 2,3)



*These Covariates are belong to donor.



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CONCLUSION

Tabnet performs better than decision tree models in predicting acute kidney rejection in the first 6 months.

Once deployed as a medical tool, Tabnet can also identify the rank of observed covariates per individual as a priceless insight for healthcare professionals.

Tabnet identifies that the top 30 percentile of ranked covariates is mostly related to the donors, including various infections and cancer history.

The two recipient-related covariates were recipient ethnicity and A2/A2B eligibility (Blood type B recipients are eligible to match with type A2 and A2B donors), both also identified by XGBoost.

ACKNOWLEDGEMENTS

We would like to sincerely thank Health Canada for their kind support and funding the challenge "Machine learning to improve organ donation rates and make better matches" (Challenge ID: 201908-F0022-C00008).

REFERENCES

- 1-Anik, S. O., & Pfister, T. (2021, May). Tabnet: Attentive interpretable tabular learning. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 35, No. 8, pp. 6879-6887).
- 2-Asan O, Bayrak AE, Choudhury A. Artificial Intelligence and Human Trust in Healthcare: Focus on Clinicians. J Med Internet Res. 2020 Jun 19;22(6):e15154. doi: 10.2196/15154. PMID: 32558657; PMCID: PMC7334754.

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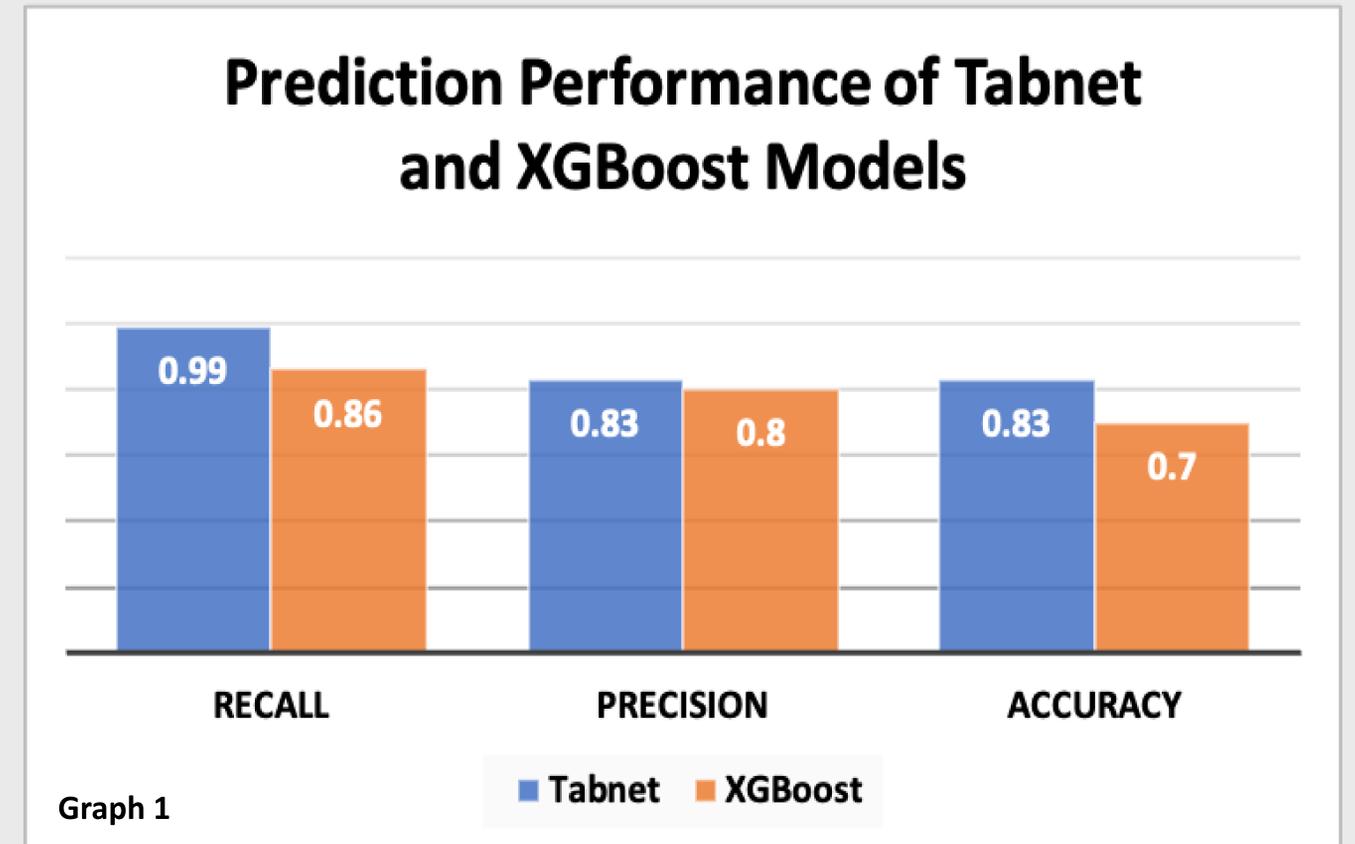
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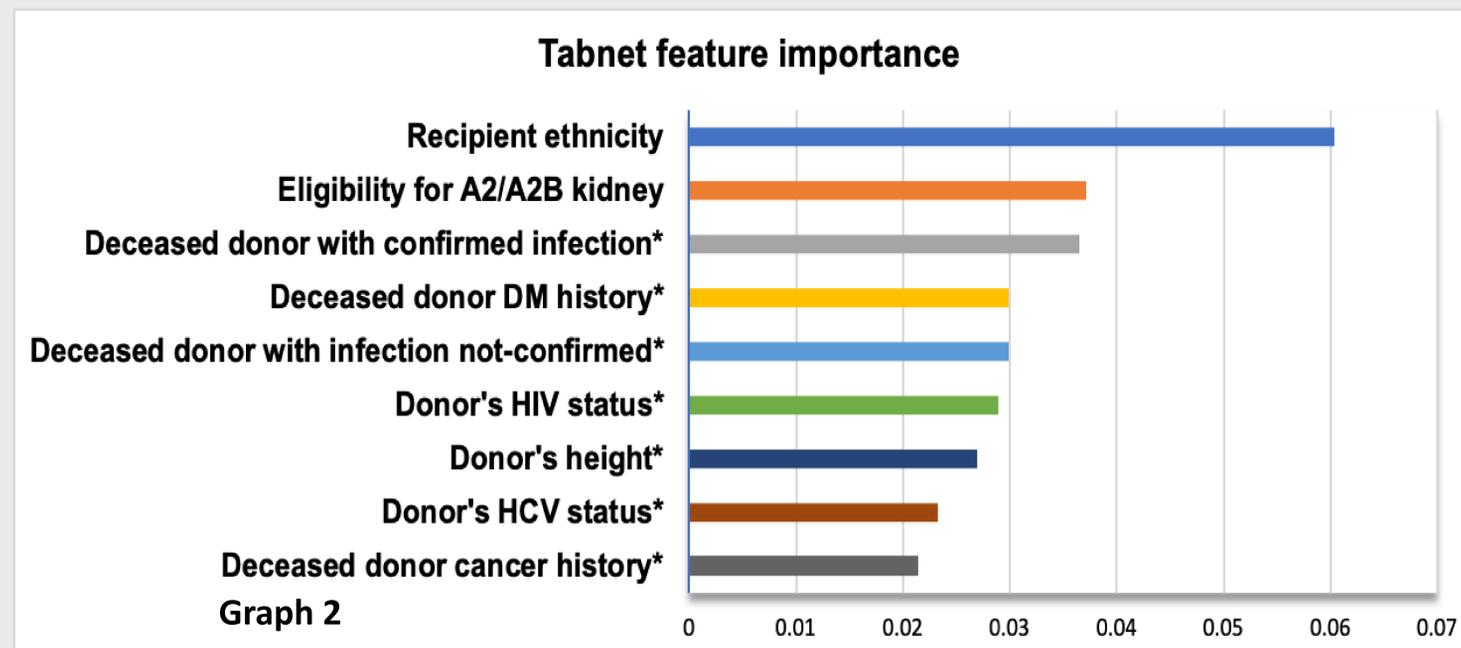
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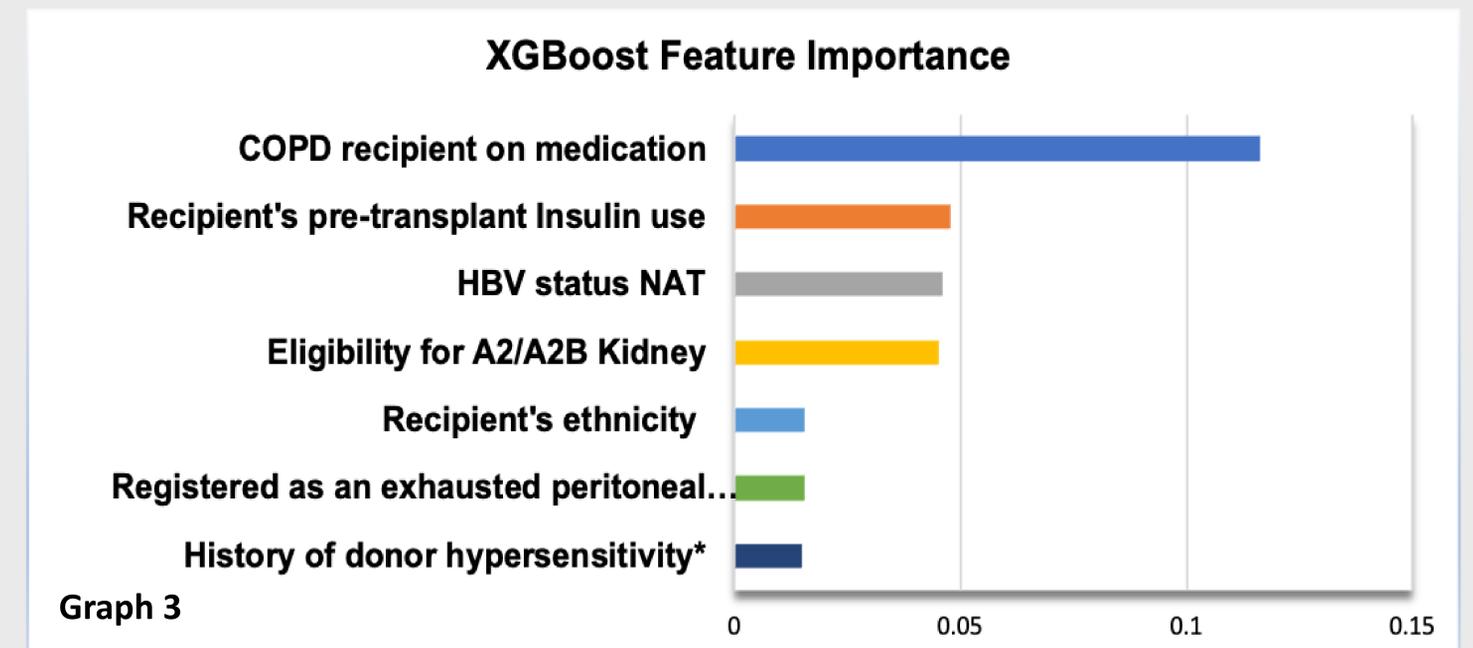
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