Predicting 1-year risk of Heart Failure for patients with Type 2 Diabetes

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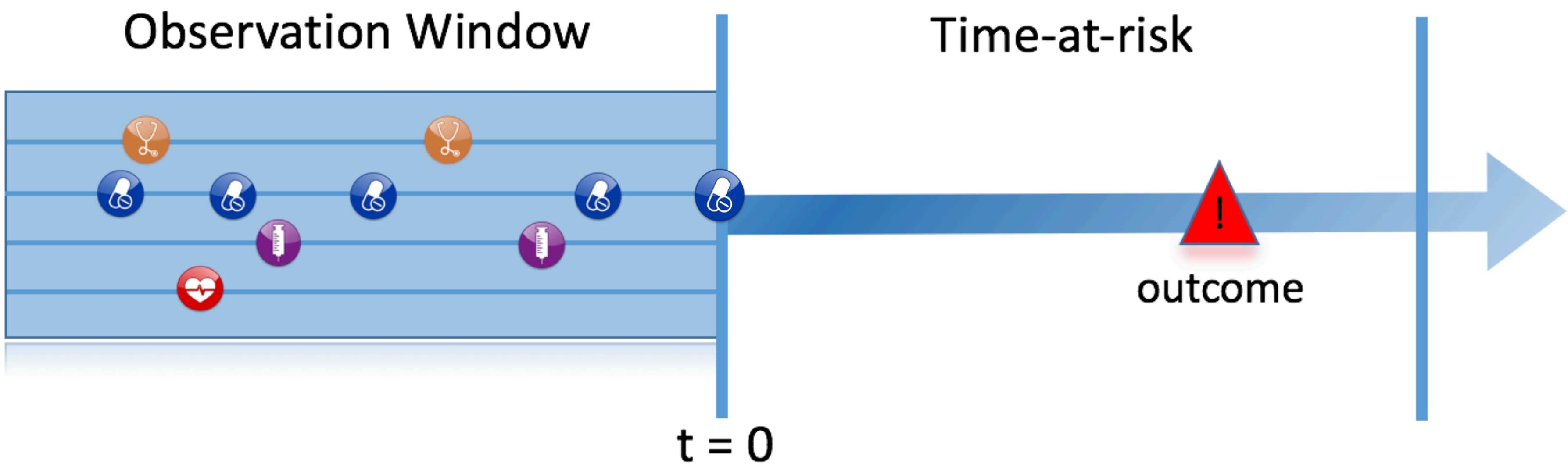
Why?

- Patient-level prediction of the risk of HF in T2DM can potentially help to define the optimal therapeutic strategy and can improve healthcare outcome.
- For example, under current Diabetes Guidelines the use of Thiazolidinediones (TZDs) is cautioned in patients at risk of HF.
- No viable prediction models exist for this problem.
- There is a need for an effective, well calibrated, externally validated prediction model.

Prediction Problem Definition



Among pharmaceutically treated T2DM patients (T) , we aim to predict which patients at a defined moment in time (t=0) will experience Heart Failure (O) during a time-at-risk of 1 year. Prediction is done using only information about the patients in an observation window prior to that moment in time.

Pharmaceutically treated T2DM

- Initial Event Cohort
  - Metformin, DPP-4 inhibitors, GLP1s, SGLT2s, TZDs, Sulfonylureas, Insulin
- at least 1 occurrences of a condition occurrence of Type II Diabetes
  - starting between all days Before and 365 days After event index date

- 365 days continuous observation

- Inclusion Criteria #1: No Type I diabetes
- Inclusion Criteria #2: No Secondary Diabetes

- Limit qualifying cohort to: earliest event per person

Cohort Definition available at:
http://www.ohdsi.org/web/atlas/#/cohortdefinition/1769345

Heart Failure

- A condition occurrence of Heart Failure
- Inpatient Visit (if available in database)

- Limit qualifying cohort to: **all events per person.**

Cohort Definitions available at:

Hospitalisation:

http://www.ohdsi.org/web/atlas/#/cohortdefinition/1769346

Non-Hospitalisation:

http://www.ohdsi.org/web/atlas/#/cohortdefinition/1769347

Patient Level Prediction Framework

Problem Definition → Data Extraction → Training → Internal Validation → External Validation → Dissemination

- We develo ... ultiple algorithms (Gradient Boosting ... Forest)
- We used ... nt:
  - Gen
  - Age
  - Race
  - Ethn
  - Inde
  - Conc
  - Drug
  - Proc
  - Mea

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Design and implementation of a standardized framework to generate and evaluate patient-level prediction models using observational healthcare data

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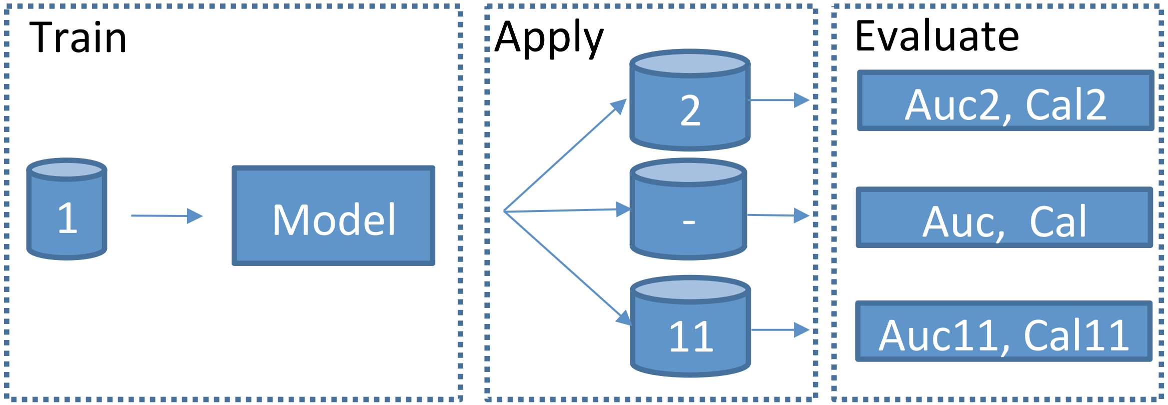
Abstract

Objective

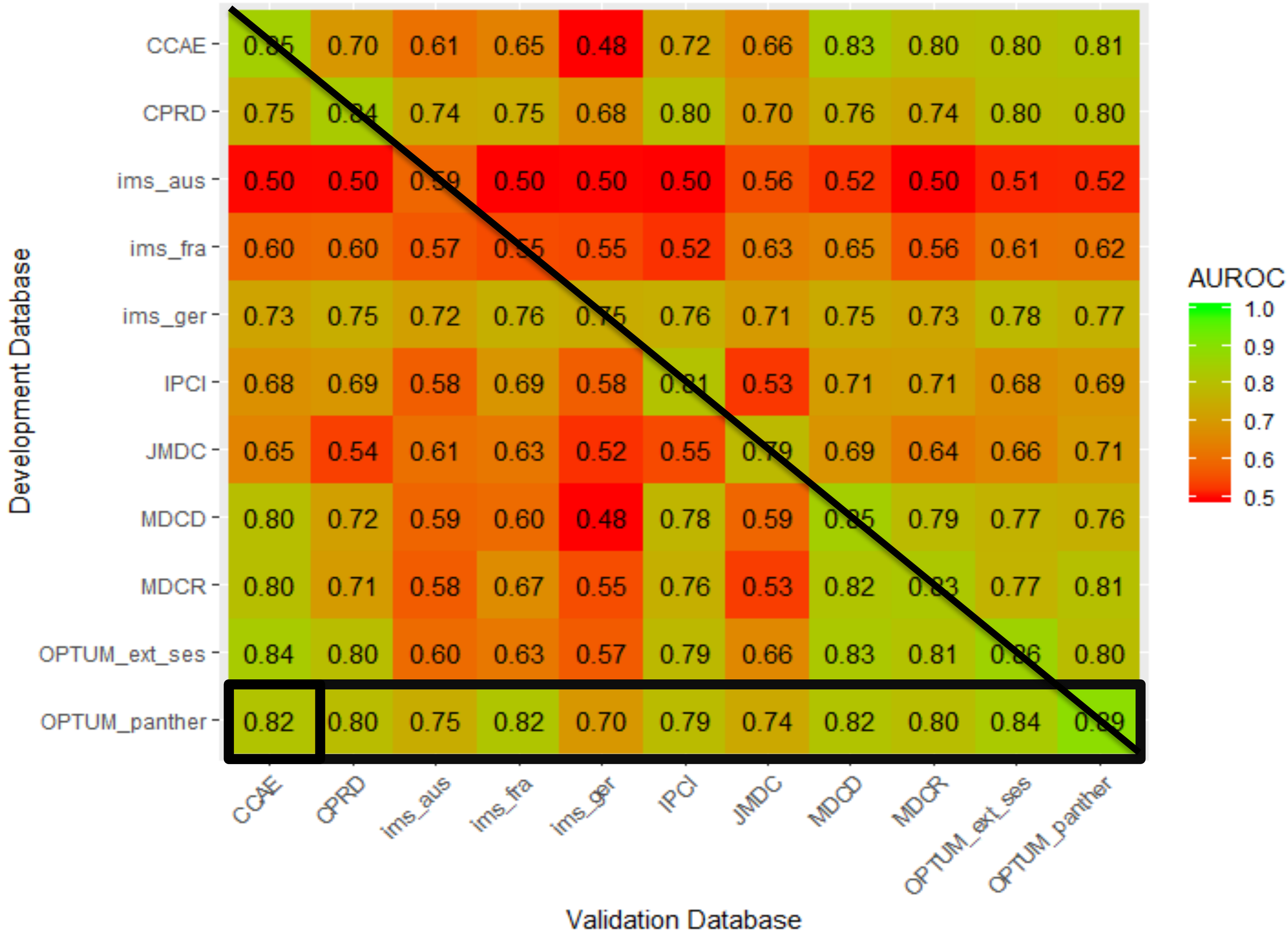
To develop a conceptual prediction model framework containing standardized steps and describe the corresponding open-source software developed to consistently implement the framework across computational environments and observational healthcare databases to enable model sharing and reproducibility.

External Validation

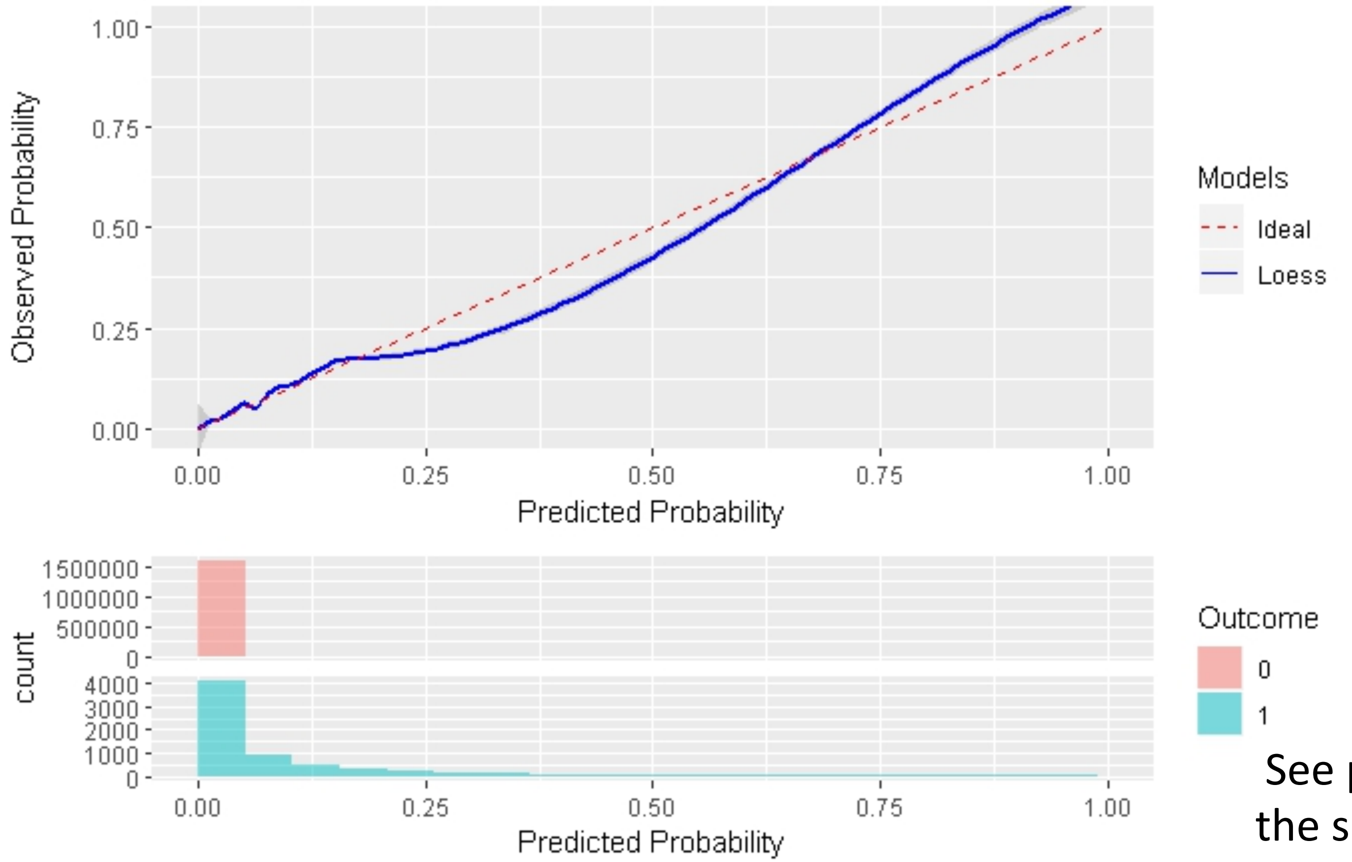


Database	# of T2DM	Outcome	# of HF
CPRD	196049	HF	1437
ims_aus	2679	HF	48
ims_fra	6364	HF	65
ims_ger	117179	HF	4668
IPCI	11600	HF	172
JMDC	15850	Inpatient HF	343
MDCD	100645	Inpatient HF	2258
MDCR	212591	Inpatient HF	4621
OPTUM_ext_ses	921273	Inpatient HF	14724
OPTUM_panther	1609677	Inpatient HF	7037
CCAE	856859	Inpatient HF	3105

Results


Development Database
CCAE 0.85 0.70 0.61 0.65 0.48 0.72 0.66 0.83 0.80 0.80 0.81
CPRD 0.75 0.84 0.74 0.75 0.68 0.80 0.70 0.76 0.74 0.80 0.80
ims_aus 0.50 0.50 0.59 0.50 0.50 0.50 0.56 0.52 0.50 0.51 0.52
ims_fra 0.60 0.60 0.57 0.55 0.55 0.52 0.63 0.65 0.56 0.61 0.62
ims_ger 0.73 0.75 0.72 0.76 0.75 0.76 0.71 0.75 0.73 0.78 0.77
IPCI 0.68 0.69 0.58 0.69 0.58 0.81 0.53 0.71 0.71 0.68 0.69
JMDC 0.65 0.54 0.61 0.63 0.52 0.55 0.79 0.69 0.64 0.66 0.71
MDCD 0.80 0.72 0.59 0.60 0.48 0.78 0.59 0.85 0.79 0.77 0.76
MDCR 0.80 0.71 0.58 0.67 0.55 0.76 0.53 0.82 0.83 0.77 0.81
OPTUM_ext_ses 0.84 0.80 0.60 0.63 0.57 0.79 0.66 0.83 0.81 0.86 0.80
OPTUM_panther 0.82 0.80 0.75 0.82 0.70 0.79 0.74 0.82 0.80 0.84 0.89
CCAE
CPRD
ims_aus
ims_fra
ims_ger
IPCI
JMDC
MDCD
MDCR
OPTUM_ext_ses
OPTUM_panther
Validation Database
AUROC
1.0
0.9
0.8
0.7
0.6
0.5

Optum Panther Calibration



See poster 27 in the showcase for more on the smooth calibration

Conclusions

- Very good model performance across diverse external validation sets with respect to discrimination and calibration.
- The study demonstrates the impact of the OHDSI Patient Level Prediction framework on prediction model generation and external validation. Creating capabilities to do this at a global scale.

If you are a data stakeholder you can validate this study using the package available at:
https://github.com/OHDSI/StudyProtocolSandbox/tree/master/HFinT2DMValidation