

Multiple Sclerosis Survival Prediction Results from DSM-COMP BIO UNITO

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Methods: survival models

Submitted models (linear):

- CoxNet: Cox regression with ElasticNet regularization
- CWGBSA: Component-wise Gradient Boosting Survival Analysis
- EvilCox: CoxNet model with features selected by CWGBSA

Also tested but not submitted (non linear):

- Random Survival Forest
- Gradient Boosting Survival Analysis

All models from the *scikit-survival* Python package

Other methodological choices

Feature preprocessing and cleaning:

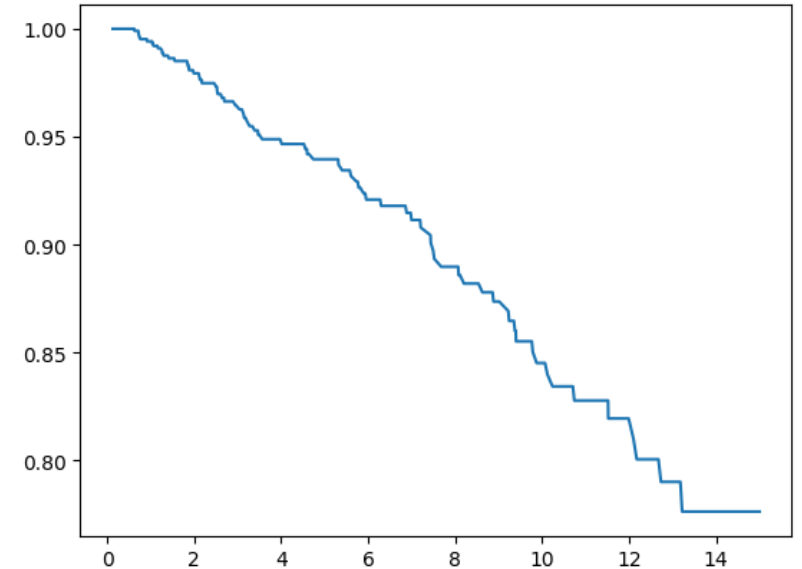
- Dynamic features: converted to static descriptive statistics
- Dropped features with more than 40% missing
- Imputed with median

Model and evaluation:

- Evaluation metric: c-index
- Cross-validation: 5-fold cross-validation over 50 reshufflings

Tasks and subtasks

- Model were evalutated and selected for Task 1
- The same models also predicted Task 2:
 - Probabilities for each interval were computed from the predicted survival curve
- Independent models were fitted for 1a and 1b subtasks



Final features

- Static: sex, onset age, diag. delay, time from onset, centre, residence classification, symptoms, pediatric MS
- EDSS:
 - stats on EDSS value: min, max, mean, std. dev., first, last
 - total number, number over 1.5/3/5.5
 - delta time/value/slope between last two observation
- Evoked potentials: none
- MRI: total number
- Relapse: total number and time from last

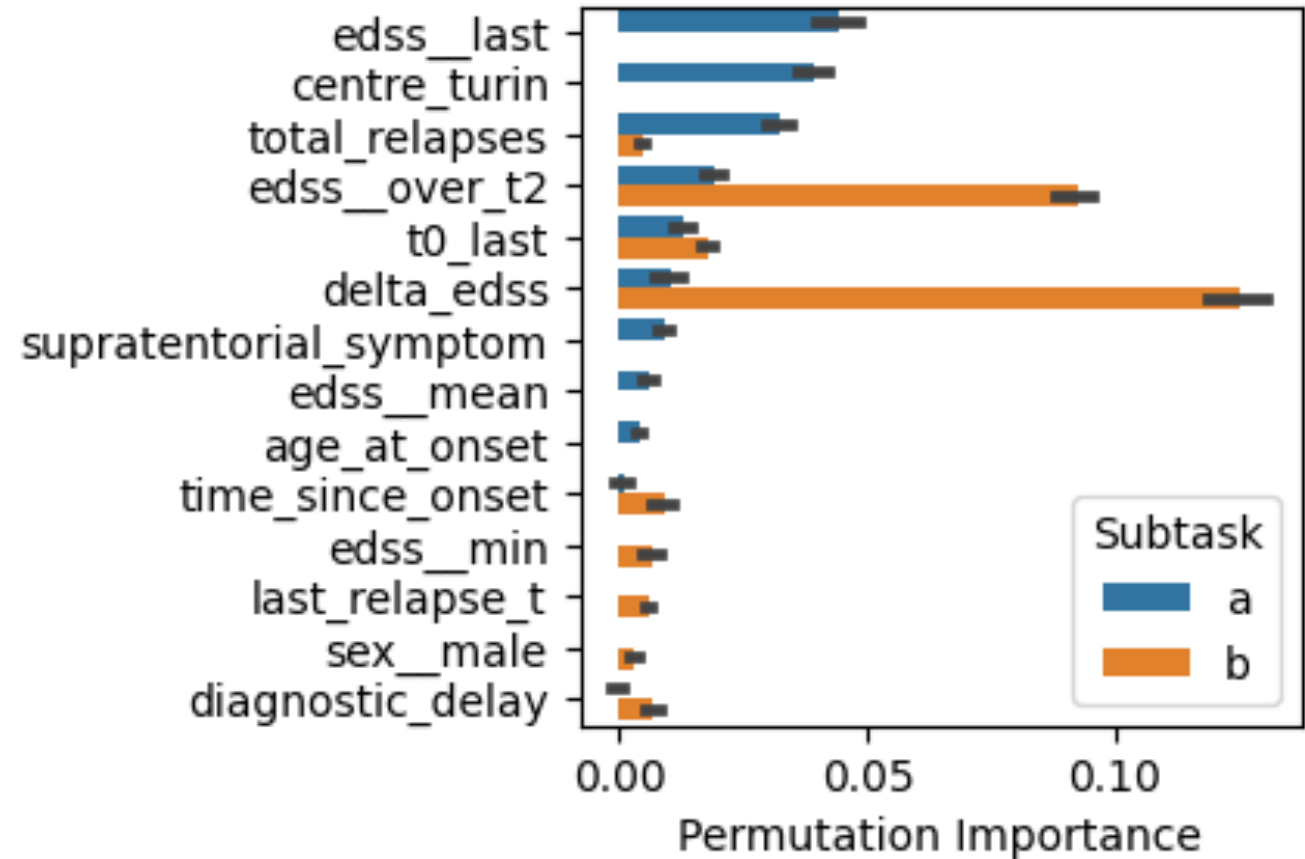
Task 1 performances

Task	Method	C-index CV	C-index Test
1a	CoxNet	0.727	0.802
	CWGBSA	0.729	0.771
	EvilCox	0.762	0.769
1b	CoxNet	0.664	0.634
	CWGBSA	0.673	0.613
	EvilCox	0.696	0.623

- CoxNet highest in test but lowest in CV
- Subtask a had higher scores than b

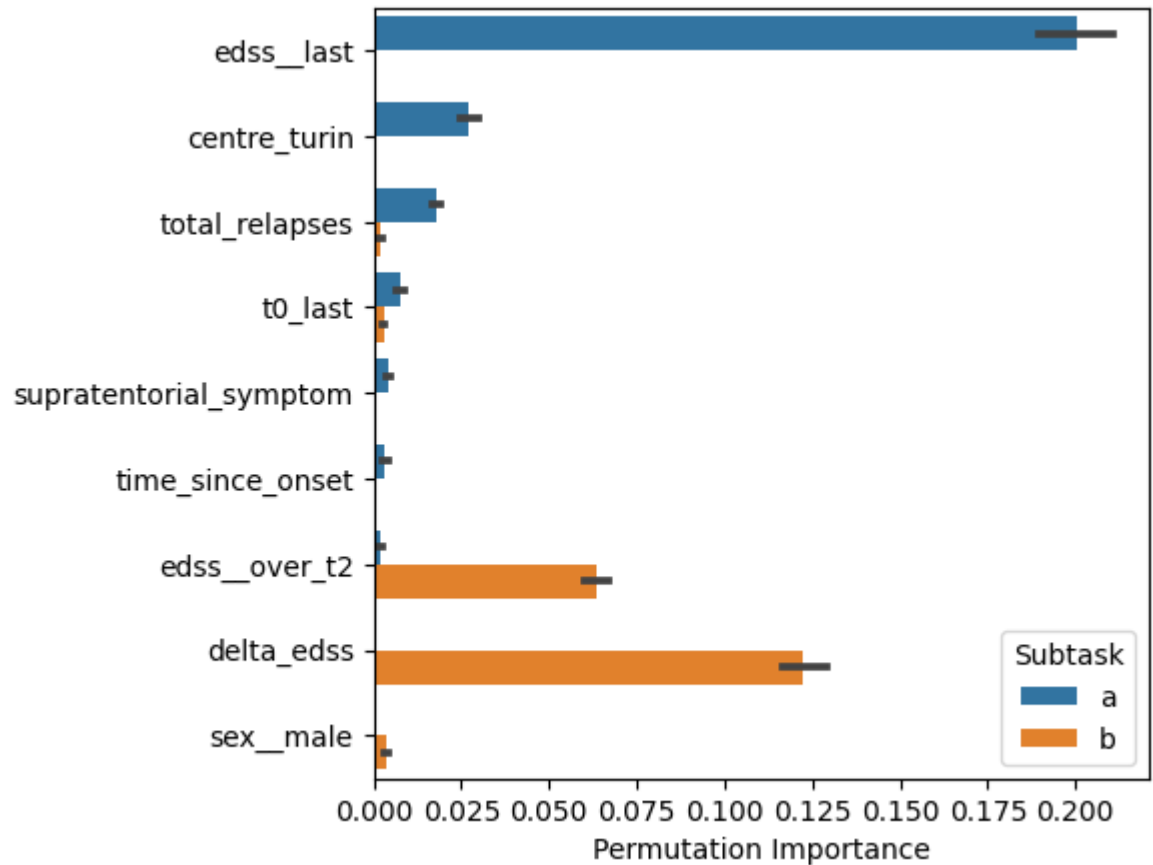
CoxNet feature importance

- Importances differ between subtasks
- EDSS features are important



CWGBSA feature importance

- Similar but sparser selection
- EvilCox uses features with permutation importance greater than 0.0001 for each subtask



Final observations

- EDSS derived outcomes are better predicted by EDSS derived features
- Feature selection without cross-validation lead to overfitting
- Linear models performed better
- Cox regression, though «very classical», is often a strong performer for survival prediction

Thank you for your attention