CAISR

Centre for Applied Intelligent Systems Research

Knowledge Foundation

Predictive Modelling using Electronic Health Records

Background

Anticipating patient outcomes facilitates clinicians to sketch timely, informed and personalized care planning. Case in point: Determining 30-day readmission risk for heart failure patients hospitalized in Halland, Sweden.

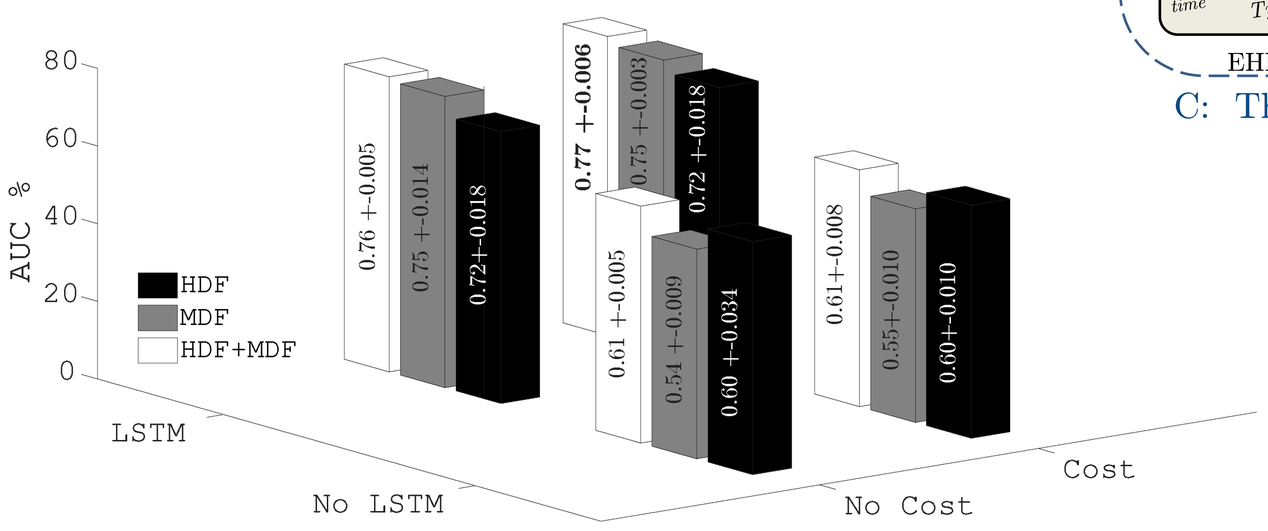
Machine learning can provide actionable insights if applied on electronic health records. The principal challenge is to model the complexity of EHRs to represent patients.

Results

Our 30-day readmission prediction model achieves a ROC-AUC of 0.77 (+- 0.006) on the test set.

Adding expert features to automatic deep features results in a significant 3% increase in the model performance.

Capturing the visits sequentially adds a significant 26% rise in the prediction performance compared to a memory-less neural network.



Estimated annual savings (MSEK)

Success rate	Intervention cost (SEK)				
0.5	30.17	27.33	24.56	21.8	19.03
0.45	26.86	24.04	21.28	18.51	15.75
0.4	23.55	20.75	17.99	15.22	12.46
0.35	20.23	17.47	14.7	11.94	9.17
0.3	16.95	14.18	11.42	8.65	5.89
0.25	13.66	10.9	8.13	5.37	2.68
0.2	10.38	7.61	4.85	2.14	0.62
0.15	7.09	4.33	1.61	0.28	0.01
0.1	3.81	1.07	0.06	0	0
	1000	**2000**	**3000**	**4000**	**5000**

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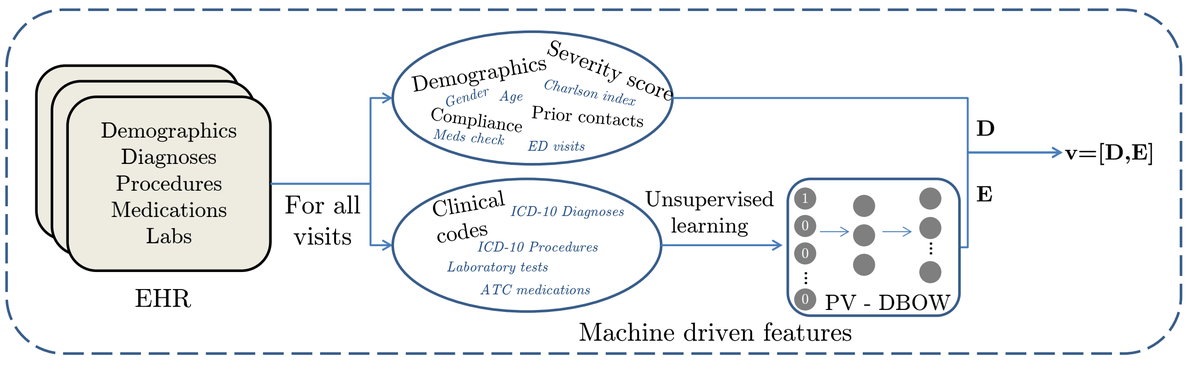
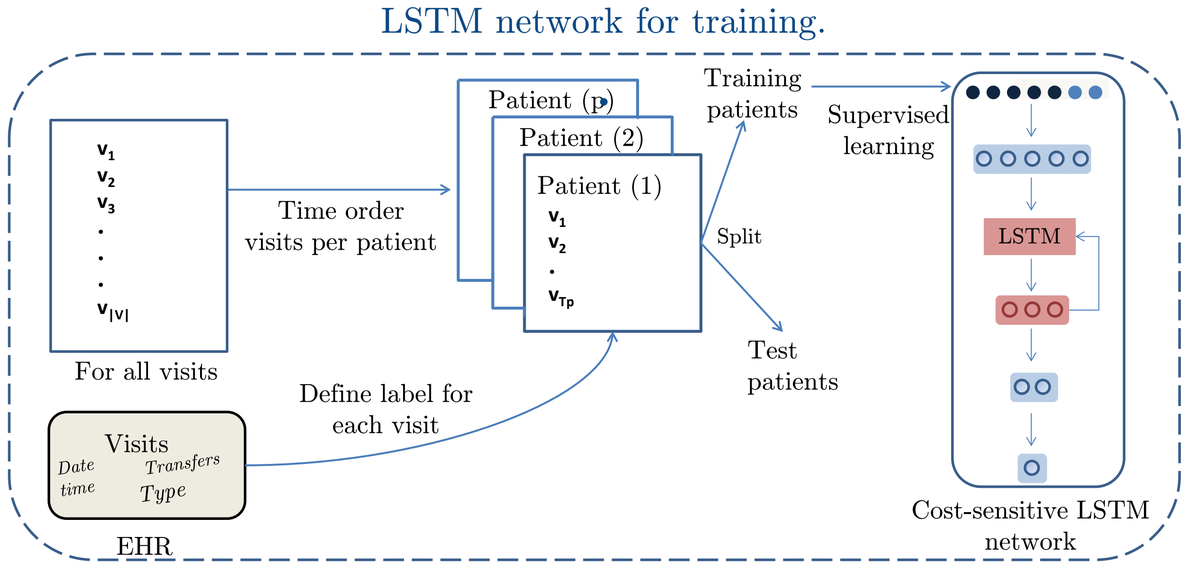
Method

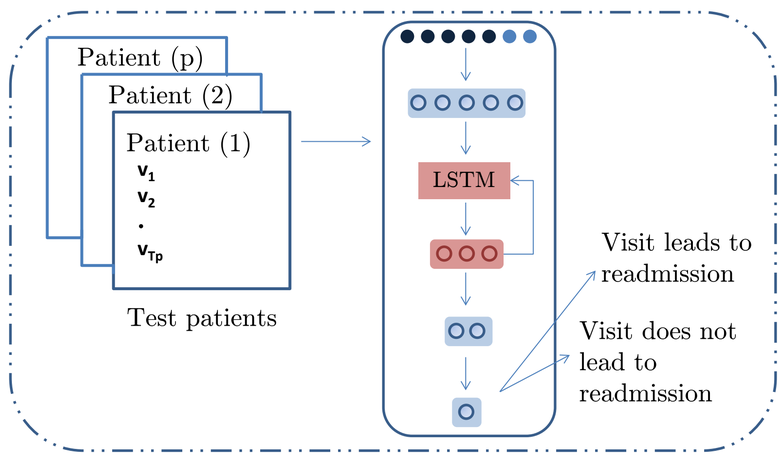
A: Generate visit representations from expert and machine-derived features.



B: The visit representations are fed sequentially in a cost-sensitive LSTM network for training.



C: The test patients are fed to the trained network to predict 30-day readmission risk for each visit.



Conclusion

Word embeddings and LSTMs are promising techniques to represent clinical concepts and capture event temporality respectively from raw data. Their prediction performance can be complemented by including domain knowledge.

Understanding predictors responsible for adverse outcomes is important to suggest interventions and revamp care policies.

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