



Predicting Patient Outcomes with Graph Representation Learning

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Electronic Health Records in the ICU

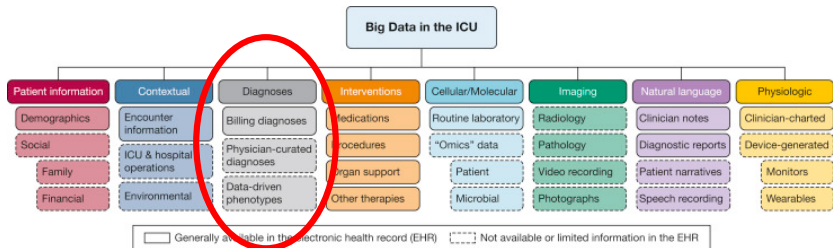
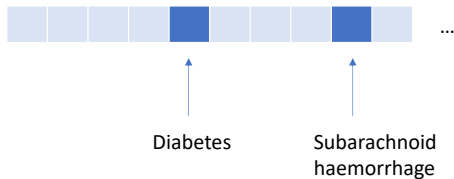


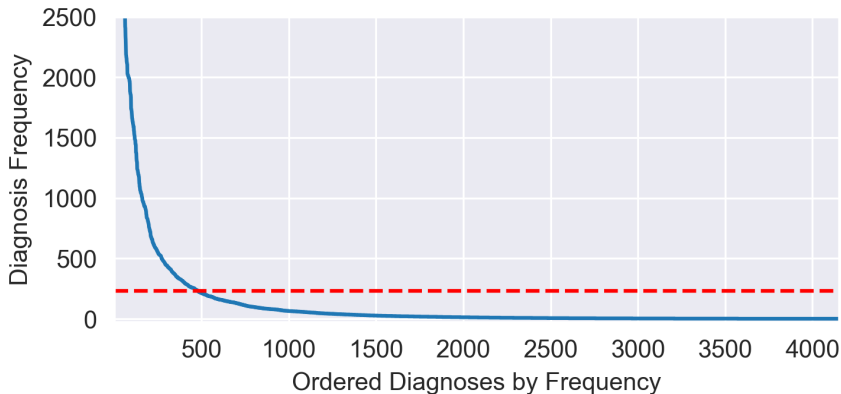
Diagram: Sanchez-Pinto et al. 2018

Diagnosis Information is Hard to Use

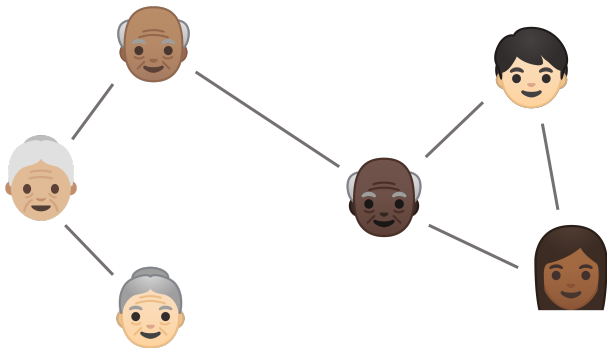


- ▶ The large number of possibilities make distinguishing between patterns of comorbidity difficult.
- ▶ There is a lack of data for rarer combinations.

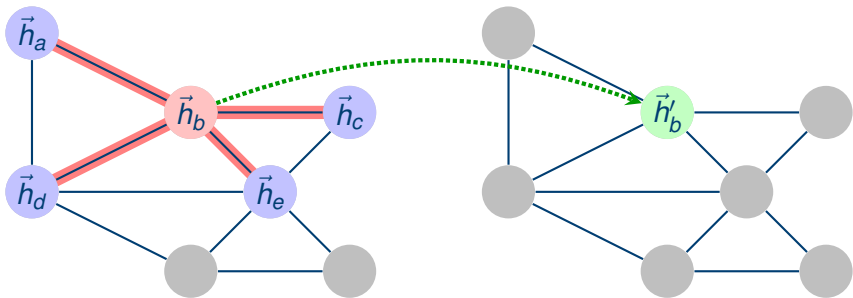
Distribution of Diagnoses in the eICU Database



“Relatedness”: Grouping Similar Patients



Graph Neural Networks (GNNs)



Graph Construction

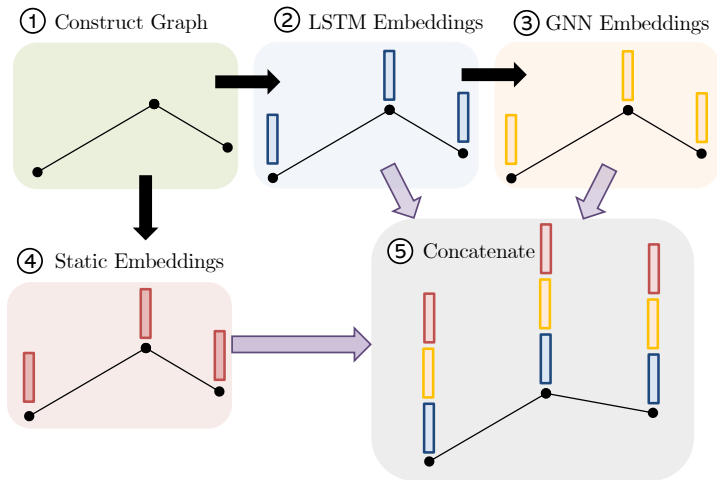
The “relatedness” score between two patients i and j is given by:

$$\mathcal{M}_{ij} = a \overbrace{\sum_{\mu=1}^m \left(\mathcal{D}_{i\mu} \mathcal{D}_{j\mu} (d_{\mu}^{-1} + c) \right)}^{\text{Shared Diagnoses}} - \overbrace{\sum_{\mu=1}^m (\mathcal{D}_{i\mu} + \mathcal{D}_{j\mu})}^{\text{All Diagnoses}} \quad (1)$$

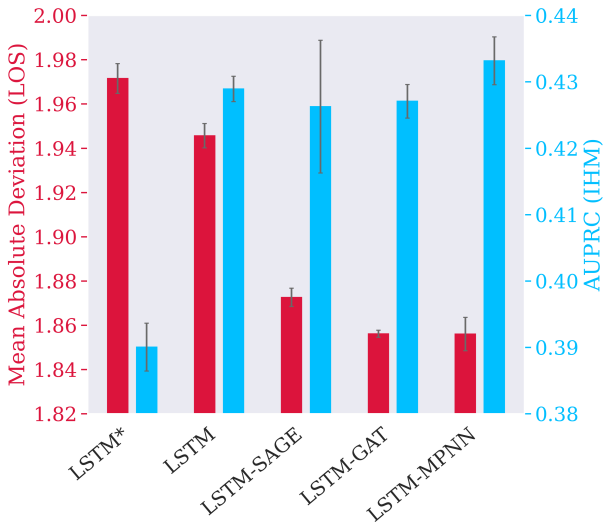
where

- ▶ $\mathcal{D} \in \mathbb{R}^{N \times m}$ is a diagnosis matrix,
- ▶ N is the number of patients,
- ▶ m is the number of unique diagnoses,
- ▶ d_{μ} is the frequency of diagnosis μ ,
- ▶ a and c are tunable constants.

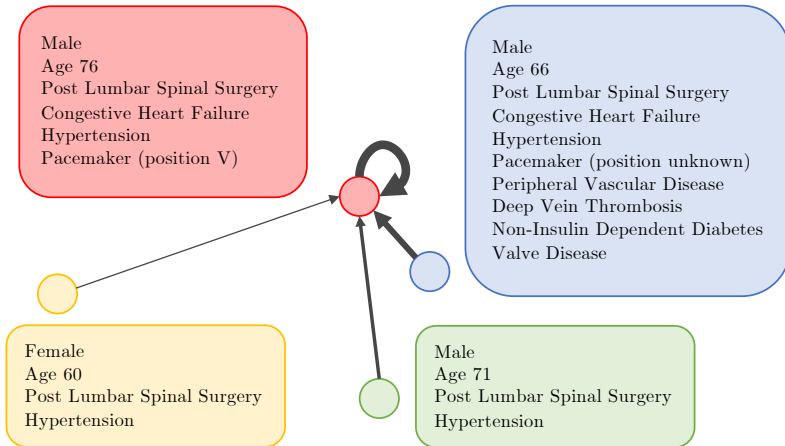
Hybrid LSTM-GNN Model



Results



Visualisation: LSTM-GAT* attention weights





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