Dual Medical Ontology Representation Learning Task Dependent Multi-task Prediction Correlation Enhanced Diagnosis Ontology **Procedure Ontology Next Diagnoses Next Procedures Hierarchical Propagation Procedures Predictive MLP Task-dependence** $\mathbf{\hat{y}}_t^d$ **Diagnoses Predictive MLP** Top-down Propagation $\mathbf{\tilde{h}}_{t}^{d}$ $\mathbf{\tilde{h}}_{t}^{p}$ **Bi-GRU** Diagnosis Code A priori diagnosis-procedure interaction **Bi-GRU Bi-GRU** Embedding Diagnosis-Procedure Reconstructed \mathbf{E}^d Interaction Interaction **Bottom-up Propagation** \rightarrow tanh($\mathbf{E}^d \mathbf{x}_t^d$) $tanh(\mathbf{E}^{p}\mathbf{x}_{t}^{p})$ $\mathbf{E}^d\mathbf{E}^p^{\mathbf{T}}$ q_i 0 1 0 1 1 ··· X_t \mathbf{X}_{t}^{P} 1 0 0 0 1 ... \mathbf{E}^p 440.31 Diagnosis Procedure A priori ▶ Reconstructed Procedure Code Leaf Code Propagation codes codes 389.1 428.0 Embedding

