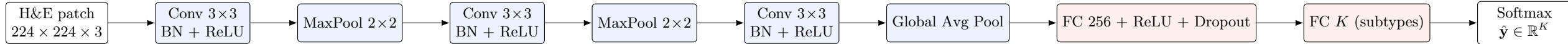
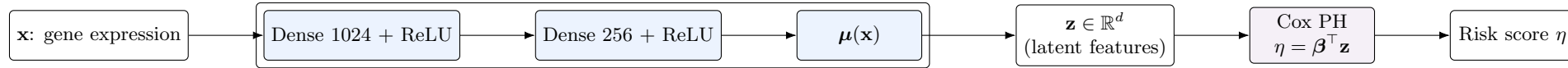


loss: cross-entropy



spatial features \rightarrow vector

VAE Encoder (pretrained on TCGA)



Optimize partial log-likelihood

VAE pretrained on TCGA

Clinical covariates
(age, stage, ...)

\mathbf{x} : genes

Encoder

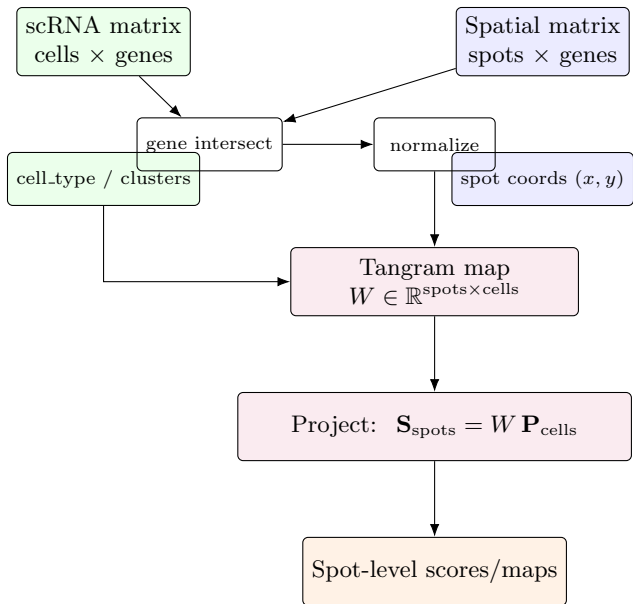
\mathbf{z} (latent)

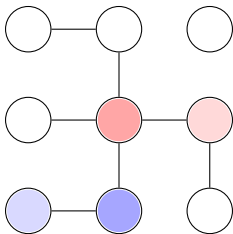
Concatenate
 $[\mathbf{z}; \mathbf{c}]$

Cox PH
 $\eta = \boldsymbol{\beta}^\top [\mathbf{z}; \mathbf{c}]$

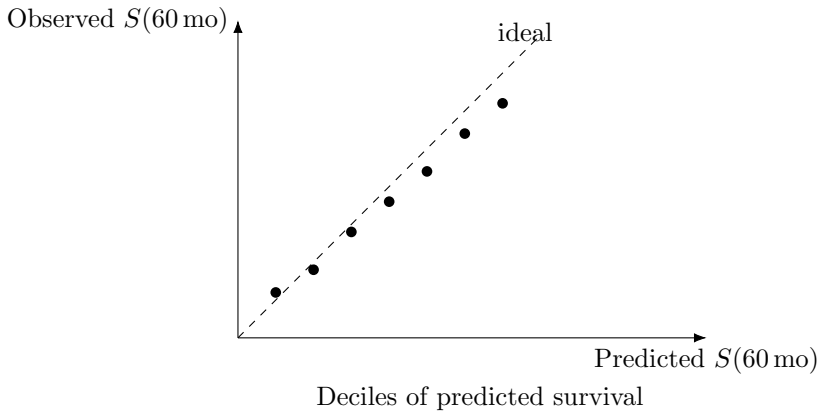
Risk score η

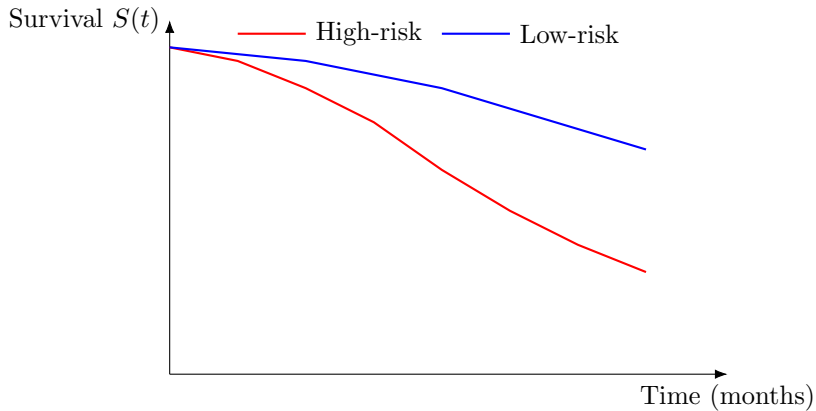
late fusion

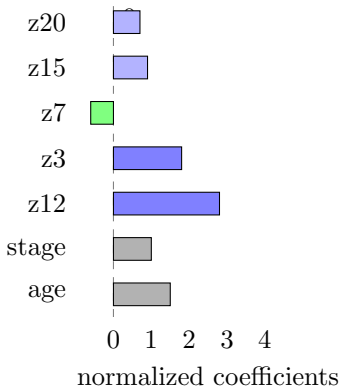


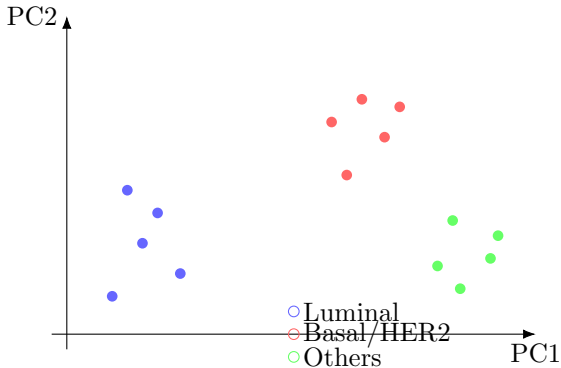


Build k NN graph on spots
compute spatial autocorrelation (Moran's I)

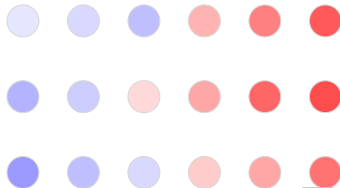








H&E (schematic) + spot grid



low risk
high risk

Data Sources

RNA-seq, Methylation, WSI (H&E), Clinical

Preprocessing

QC, Normalization, Gene Mapping

VAE (RNA)

Latent z

ResNet (WSI)

Tiles \rightarrow Embeds

Transformer/ViT

Patches \rightarrow Context

MIL-Attention

Slide-level

GNN (Spatial)

Passing

Fusion Layer

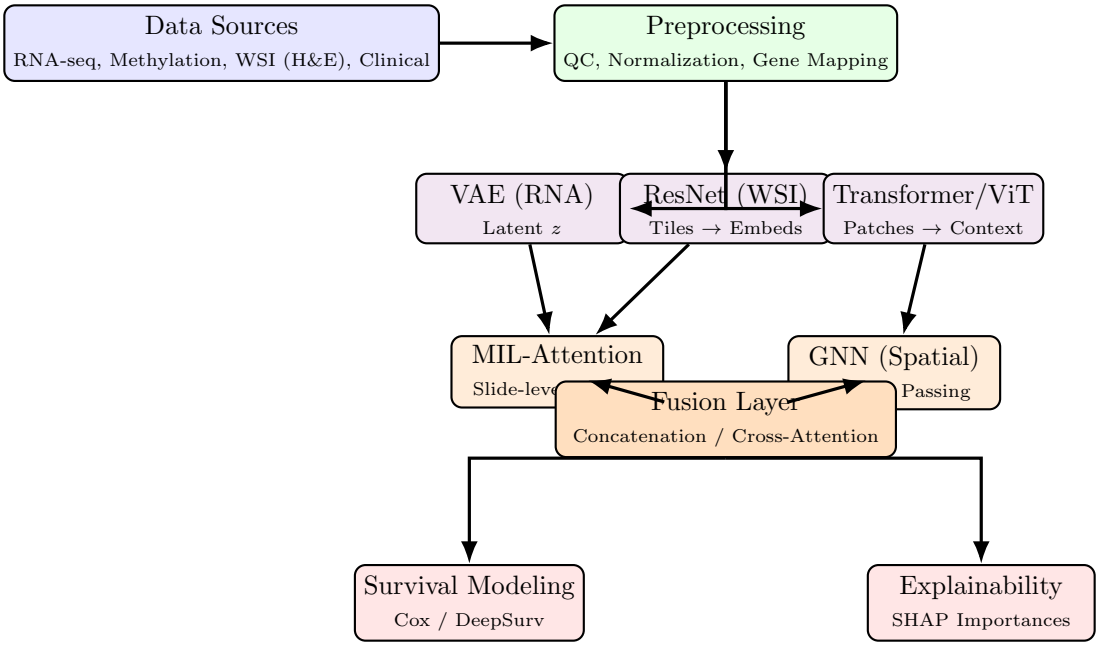
Concatenation / Cross-Attention

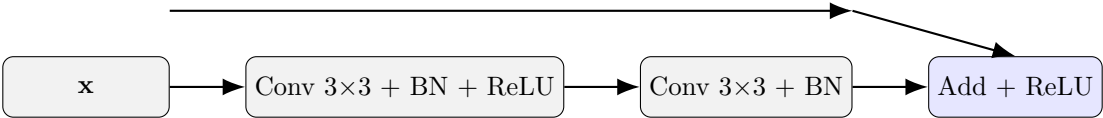
Survival Modeling

Cox / DeepSurv

Explainability

SHAP Importances





Patch Embeddings + Positional Encodings



Multi-Head Self-Attention



Add & Norm



FFN (MLP: GELU)



Add & Norm