Table 1. Hyperparameters considered for DTS

| **Hyperparameters** | **Values considered** |
| --- | --- |
| **Rank for factorized data (CP-ALS)** | 2-200 |
| **Encoding layers (Decoding layers are inverse)** | [1024, 1024]; [512, 512];[256, 256]; [128, 128]; [1024, 512]; [1024, 256];[1024, 128]; [512, 256]; [512, 128]; [256, 128] [1024,1024, 128] [1024, 512, 128];[1024, 128, 128]; [512, 256]; [512, 128]; [256, 128] |
| **Encoded Features** | 8, 16, 32 |
| **Survival Net** | [64, 64]; [32,32 ]; [16,16]; [64, 32]; [64, 16]; [32,16]; [64,64,16];[32,32,16] |
| **Learning rates** | , , 5 × |
| **Loss weight** | 0.3, 0.4, 0.5, 0.6, 0.7 |
| **Batch Size** | 16, 64, 128, 256, 512 |
| **Time Interval** | 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 |

Table 2. Comparisons of different survival prediction models

| ***Data Integration Type*** | ***Survival Function*** | ***Training* *C-index***  ***(95% CI)*** | ***Testing* *C-index***  ***(95% CI)*** |
| --- | --- | --- | --- |
| ***Penalized Cox: GE*** | Lasso Cox | **0.766** (0.727, 0.805) | **0.675** (0.659, 0.691) |
| ***Penalized Cox: CN*** | Lasso Cox | **0.696** (0.682, 0.709) | **0.647** (0.626, 0.669) |
| ***Penalized Cox: DM*** | Lasso Cox | **0.770** (0.732, 0.807) | **0.670** (0.647, 0.694) |
| ***I-Boost permutation*** | CoxPH | **0.771** (0.759, 0.784) | **0.602** (0.579,0.625) |
| ***Penalized Cox: GE+DM+CN* *(Concatenation)*** | Lasso Cox | **0.772** (0.730, 0.814) | **0.670** (0.647, 0.692) |
| ***TF-Penalized Cox*** | Ridge Cox | **0.720** (0.703, 0.738) | **0.684** (0.664, 0.705) |
| ***Deepsurv: GE*** | CoxPH | **0.858** (0.794, 0.923) | **0.614** (0.566, 0.663) |
| ***TF-Deepsurv*** | CoxPH | **0.725** (0.703, 0.746) | **0.659** (0.628, 0.690) |
| ***DeepTensorSurvival: Rank17*** | Partial Logistic Hazard | **0.721** (0.706, 0.735) | **0.700** (0.676, 0.721) |

Table 3. Analysis of model significance using Wilcoxon signed rank test

| **Baseline: Penalized Cox on GE** | **P-value** |
| --- | --- |
| **TF-Penalized Cox** | 0.08 |
| **I-Boost permutation** | 1 |
| **Deepsurv on GE** | 0.99 |
| **TF-Deepsurv** | 0.85 |
| **DTS** | 0.01 |

×××××

DM

CN

GE

×××××

Tensor

l\_b

Training

Testing

**Figure 1. Flowchart of the Tensor Factorization**

GE = Gene Expression, CN = Copy Number, DM = DNA Methylation.

…

…

…

…

Survival

Network

**Figure 2. An Overview of the Deep Tensor Survival Model**

CP-ALS

DM

CN

GE

Tensor

…

…

Embedded latent features

Encoded

Reconstruction

Encoding Layers

Decoding Layers

**Figure 3. TF-Penalized Cox Model: C-index versus Rank Visualization**

Chart

Description automatically generated