# LVC 3: Glossary of Notations

**Recurring Notations from lectures 1 and 2:**

$L$ = The original user-item interaction matrix

$L_{ij}$ = Likelihood of the $i^{th}$ user matching with the $j^{th}$ item in the user-item interaction matrix

$L_i$ = The average of observed entries in the $i^{th}$ row of the user-item interaction matrix

$n_i$ = The number of observed entries in the $i^{th}$ row of the user-item interaction matrix

$L_j$ = The average of observed entries in the $j^{th}$ column of the user-item interaction matrix

$n_j$ = The number of observed entries in the $j^{th}$ column of the user-item interaction matrix

$x_i$ = Features of the $i^{th}$ user

$y_j$ = Features of the $j^{th}$ item

$U$ = A user embedding matrix $U \in R^{n \times r}$, where row $i$ is the embedding for user $i$ denoted by $u_i$

$S$ = The sigma matrix; a diagonal matrix with shape $r \times r$, where $r$ is the rank/number of latent features

$V^T$ = An item embedding matrix $V \in R^{m \times r}$, where row $j$ is the embedding for item $j$ denoted by $v_j$

$r$ = rank/number of latent features

$s_k$ = The $k^{th}$ value of the sigma matrix $S$

$u_{ik}$ = The value in the $i^{th}$ row and $k^{th}$ column of the matrix $U$

$v_{jk}$ = The value in the $j^{th}$ row and the $k^{th}$ column of the matrix $V^T$

**Notations introduced in lecture 3:**

$f_{obs}(x_i, y_j)$ = A mathematical function/model learned to make predictions using the observed features of users and items

$f_{latent}(u_i, v_j)$ = A mathematical function/model learned to make predictions using the latent features of users and items

$L^{obs}$ = The matrix of values predicted by the function $f^{obs}$

$L_{ij}^{obs}$ = Predicted value at $i^{th}$ row and the $j^{th}$ column of $L^{obs}$

$L_{ij}^{diff}$ = Difference between the $i^{th}$ row and the $j^{th}$ column of matrix $L$ and the predicted matrix $L^{obs}$

$L^{ME}$ = Resultant matrix of matrix estimation on the matrix $L^{diff}$

$\widehat{L}_{ij}$ = Combined estimate value of the $i^{th}$ row and the $j^{th}$ column of $L^{obs}$ and $L^{ME}$

$L_{ij}(t)$ = Value of the $i^{th}$ row and the $j^{th}$ column at time $t$ of matrix $L$

$u_i(t)^T$ = The $i^{th}$ latent feature at time $t$ of matrix $U$

$u_i(t)^T$ = Transpose of the $i^{th}$ latent feature at time $t$ of matrix $U$

$v_j(t)$ = The $j^{th}$ latent feature at time $t$ of matrix $V$

$X$ = The time Series data

$X(t)$ = Time Series data at a given time $t$

$T$ = The time of the last instance of the time series data

$R^d$ = Real numbers in the $d$-dimensional space

$P$ = The page matrix

$P_{ij}$ = The entry at the $i^{th}$ row and the $j^{th}$ column of the matrix $P$

$(T + 1\, mod\, L)$ = The remainder after diving $T + 1$ by $L$

$Z$ = Concatenation of page matrices for all users and items across time $t$

$\hat{Z}$ = Result of performing matrix estimation over the matrix $Z$

$k$ = Number of measurements

$\hat{L}_{ij}(t)$ = Predicted value of the $i^{th}$ row and the $j^{th}$ column at time $t$

$f(u_i(t), v_j(t))$ = A mathematical function/model learned with inputs as the $i^{th}$ latent feature of users at time $t$ and $j^{th}$ latent feature of items at time $t$

$L_{ijk}(t)$ = Likelihood of the $i^{th}$ user matching with the $j^{th}$ item for a given measurement $k$ at some time $t$

$f^k_{obs}(x_i, y_j)$ = A mathematical function/model learned using the observed users and items features for a given measurement $k$

$f^k_{latent}(u_i(t), v_j(t))$ = A mathematical function/model learned over the latent features of users and items for a given time $t$ and a given measurement $k$

$Z^k$ = Stacked Page matrices for $k$ measurements

$\widehat{L}_{ijk}(t)$ = Predicted likelihood of the $i^{th}$ user matching with the $j^{th}$ item in a user-item interaction matrix for a given measurement $k$ at a given time $t$

$\widehat{L^{diff}}_{ijk}(t)$ = Result of matrix estimation on $Z^k$

$L^{obs}_{ijk}$ = Predicted likelihood of the $i^{th}$ user matching with the $j^{th}$ item in a user-item interaction matrix for a given measurement $k$