Schmidt decomposition = SVD in quantum mechanics context

state in the joint system A+B

$$|\psi\rangle = |\varphi_\alpha\rangle |\phi_\beta\rangle A^{\alpha\beta} = |u_i\rangle |v_i\rangle \lambda_i$$

($|\varphi_\alpha\rangle$: subsystem A; $|\phi_\beta\rangle$: B; "dummy"; Schmidt decomposition)

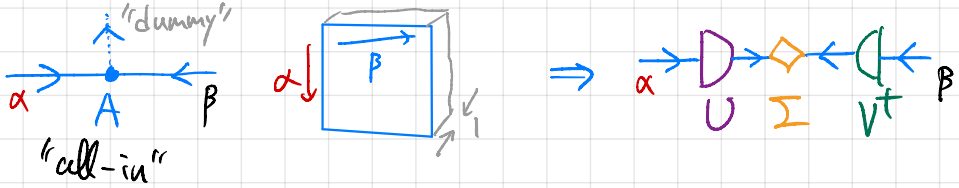
SVD: $A = U \Sigma V^\dagger$

$U = [\vec{u}_1\ \vec{u}_2 \cdots]$ $V = [\vec{v}_1\ \vec{v}_2 \cdots]$

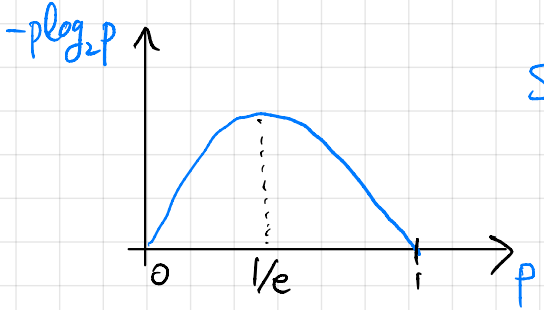
$\Sigma_{ij} = \lambda_i \delta_{ij}$

Normalization: $\langle\psi|\psi\rangle = 1 \Rightarrow \sum_i |\lambda_i|^2 = 1$

In TN diagram:



Entanglement entropy: $S(\{\lambda_i\}) = -\sum_i |\lambda_i|^2 \log_2 |\lambda_i|^2$ (to use the unit of "ebit"s)



$S(\{\lambda_i\})$ is maximal when $|\lambda_i|^2 = 1/d$ for all i's, where $d = \min(d_\alpha, d_\beta)$ ($\because -p\log_2 p$ is concave)