

TikZ tensor network diagrams

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Finite MPS:

$$|\Psi\rangle = \begin{array}{c} A_1 \quad A_2 \quad A_3 \quad \dots \quad A_{N-1} \quad A_N \\ \circ - \circ - \circ - \dots - \circ - \circ \\ | \quad | \quad | \quad \quad \quad | \quad | \end{array} . \quad (1)$$

Gauge transform:

$$\begin{array}{c} A_i \\ \circ \\ | \end{array} \rightarrow \begin{array}{c} G_{i-1}^{-1} \quad A_i \quad G_i \\ \circ - \circ - \circ \\ | \quad | \quad | \end{array} . \quad (2)$$

Left-orthogonal form:

$$\begin{array}{c} A_i \\ \circ \\ | \end{array} \rightarrow \begin{array}{c} L_i \\ \lrcorner \\ | \end{array} , \quad \begin{array}{c} L_i \\ \lrcorner \\ | \\ \lrcorner \\ L_i \end{array} = \left[\begin{array}{c} \\ \\ \\ \end{array} \right] . \quad (3)$$

Right-orthogonal form:

$$\begin{array}{c} A_i \\ \circ \\ | \end{array} \rightarrow \begin{array}{c} R_i \\ \lrcorner \\ | \end{array} , \quad \begin{array}{c} R_i \\ \lrcorner \\ | \\ \lrcorner \\ R_i \end{array} = \left] \begin{array}{c} \\ \\ \\ \end{array} \right] . \quad (4)$$

SVD:

$$\begin{array}{c} A_i \\ \circ \\ | \end{array} = \begin{array}{c} U \\ \lrcorner \\ | \end{array} - \diamond - \begin{array}{c} V^\dagger \\ \lrcorner \\ | \end{array} . \quad (5)$$

Mixed-canonical form:

$$|\Psi\rangle = \begin{array}{c} L_1 \quad L_2 \quad \dots \quad L_{i-1} \quad C_i \quad R_{i+1} \quad \dots \quad R_{N-1} \quad R_N \\ \lrcorner - \lrcorner - \dots - \lrcorner - \circ - \lrcorner - \dots - \lrcorner - \lrcorner \\ | \quad | \quad \quad \quad | \quad | \quad | \quad \quad \quad | \quad | \end{array} . \quad (6)$$

$$|\Psi\rangle = \begin{array}{c} L_1 \quad L_2 \quad \dots \quad L_{i-1} \quad L_i \quad D_i \quad R_{i+1} \quad \dots \quad R_{N-1} \quad R_N \\ \lrcorner - \lrcorner - \dots - \lrcorner - \lrcorner - \circ - \lrcorner - \dots - \lrcorner - \lrcorner \\ | \quad | \quad \quad \quad | \quad | \quad | \quad \quad \quad | \quad | \end{array} . \quad (7)$$

Unitary gauge transformation:

$$\begin{array}{c} L_i \\ \text{---} \square \text{---} \end{array} \rightarrow \begin{array}{c} U_{i-1}^\dagger \quad L_i \quad U_i \\ \text{---} \bigcirc \text{---} \square \text{---} \bigcirc \text{---} \end{array}. \quad (8)$$

Expectation value:

$$\langle \Psi | O_i | \Psi \rangle = \begin{array}{c} A_{i-1} \quad A_i \quad A_{i+1} \\ \begin{array}{c} \bigcirc \cdots \bigcirc \bigcirc \bigcirc \bigcirc \cdots \bigcirc \\ | \quad | \quad | \quad | \quad | \\ \bigcirc \cdots \bigcirc \bigcirc \bigcirc \bigcirc \cdots \bigcirc \\ | \quad | \quad | \quad | \quad | \\ \square \quad \square \quad \square \quad \square \quad \square \\ | \quad | \quad | \quad | \quad | \\ \bigcirc \cdots \bigcirc \bigcirc \bigcirc \bigcirc \cdots \bigcirc \end{array} \end{array}. \quad (9)$$

$$\langle \Psi | O_i | \Psi \rangle = \begin{array}{c} L_{i-1} \quad C_i \quad R_{i+1} \\ \begin{array}{c} \square \cdots \square \bigcirc \bigcirc \square \cdots \square \\ | \quad | \quad | \quad | \quad | \\ \square \cdots \square \bigcirc \bigcirc \square \cdots \square \\ | \quad | \quad | \quad | \quad | \\ \square \quad \square \quad \square \quad \square \quad \square \\ | \quad | \quad | \quad | \quad | \\ \square \cdots \square \bigcirc \bigcirc \square \cdots \square \end{array} \end{array} = \begin{array}{c} C_i \\ \begin{array}{c} \bigcirc \\ | \\ \square \\ | \\ \bigcirc \end{array} \end{array}. \quad (10)$$

Multi-site expectation value:

$$\langle \Psi | O | \Psi \rangle = \begin{array}{c} L_{i-1} \quad C_i \quad R_{i+1} \\ \begin{array}{c} \square \cdots \square \bigcirc \bigcirc \square \cdots \square \\ | \quad | \quad | \quad | \quad | \\ \square \cdots \square \bigcirc \bigcirc \square \cdots \square \\ | \quad | \quad | \quad | \quad | \\ \square \quad \square \quad \square \quad \square \quad \square \\ | \quad | \quad | \quad | \quad | \\ \square \cdots \square \bigcirc \bigcirc \square \cdots \square \end{array} \end{array}. \quad (11)$$

MPO:

$$\begin{array}{c} \square \\ | \quad | \quad | \quad | \quad | \end{array} = \begin{array}{c} \square \quad \square \quad \square \\ | \quad | \quad | \quad | \quad | \end{array}. \quad (12)$$

MPO expectation value:

$$\langle \Psi | H | \Psi \rangle = \begin{array}{c} L_{i-1} \quad C_i \quad R_{i+1} \\ \begin{array}{c} \square \cdots \square \bigcirc \bigcirc \square \cdots \square \\ | \quad | \quad | \quad | \quad | \\ \square \cdots \square \bigcirc \bigcirc \square \cdots \square \\ | \quad | \quad | \quad | \quad | \\ \square \quad \square \quad \square \quad \square \quad \square \\ | \quad | \quad | \quad | \quad | \\ \square \cdots \square \bigcirc \bigcirc \square \cdots \square \end{array} \end{array} = E_{i-1} \begin{array}{c} C_i \\ \begin{array}{c} \bigcirc \\ | \\ \square \\ | \\ \bigcirc \end{array} \end{array} F_{i+1} = E_i \begin{array}{c} D_i \\ \begin{array}{c} \bigcirc \\ | \\ \square \\ | \\ \bigcirc \end{array} \end{array} F_{i+1}. \quad (13)$$

Environment tensors:

$$E_1 \begin{array}{c} \square \\ | \quad | \quad | \end{array} \equiv \begin{array}{c} L_1 \\ \begin{array}{c} \square \\ | \\ \square \\ | \\ \square \end{array} \end{array}, \quad E_i \begin{array}{c} \square \\ | \quad | \quad | \end{array} \equiv E_{i-1} \begin{array}{c} L_i \\ \begin{array}{c} \square \\ | \\ \square \\ | \\ \square \end{array} \end{array}. \quad (14)$$

$$\begin{array}{c} \square \\ | \quad | \quad | \end{array} F_N \equiv \begin{array}{c} R_N \\ \begin{array}{c} \square \\ | \\ \square \\ | \\ \square \end{array} \end{array}, \quad \begin{array}{c} \square \\ | \quad | \quad | \end{array} F_i \equiv \begin{array}{c} R_i \\ \begin{array}{c} \square \\ | \\ \square \\ | \\ \square \end{array} \end{array} F_{i+1}. \quad (15)$$

iMPS:

$$|\Psi\rangle = \cdots \text{---} \bigcirc \text{---} \bigcirc \text{---} \bigcirc \text{---} \bigcirc \text{---} \bigcirc \text{---} \cdots. \quad (16)$$

Transfer matrix:

$$T = \begin{array}{c} \text{---} \bigcirc \text{---} \\ | \\ \text{---} \bigcirc \text{---} \end{array} . \quad (17)$$

MPS norm:

$$\langle \Psi | \Psi \rangle = \text{Diagram of a 2x5 grid of circles with horizontal and vertical connections, representing a trace of a product of matrices.} \quad (18)$$

Left-orthogonal form:

$$\begin{array}{c} \text{---} \text{---} \\ | \quad | \\ \text{---} \text{---} \\ | \quad | \\ \text{---} \text{---} \end{array} = \left[\begin{array}{c} \text{---} \\ \text{---} \end{array} \right], \quad \begin{array}{c} \text{---} \text{---} \\ | \quad | \\ \text{---} \text{---} \\ | \quad | \\ \text{---} \text{---} \end{array} \rho_L = \left[\text{---} \right] \rho_L. \quad (19)$$

Right-orthogonal form:

$$\begin{array}{c} \text{---} \text{---} \\ \text{---} \end{array} \left[\begin{array}{c} \text{---} \\ \text{---} \end{array} \right] = \left[\begin{array}{c} \text{---} \\ \text{---} \end{array} \right], \quad \rho_R \left[\begin{array}{c} \text{---} \\ \text{---} \end{array} \right] = \rho_R \left[\begin{array}{c} \text{---} \\ \text{---} \end{array} \right]. \quad (20)$$

Mixed-canonical form:

$$|\Psi\rangle = \dots - \text{AND} - \text{AND} - \text{OR} - \text{NAND} - \text{NAND} - \dots \quad (21)$$

$$= \dots - \text{AND} - \text{AND} - \text{OR} - \text{AND} - \text{AND} - \dots, \quad (22)$$

iMPS expectation value:

$$\langle \Psi | O_i | \Psi \rangle = \text{Diagram with two horizontal lines of gates and a central square} = \text{Diagram with a vertical stack of gates and a circle labeled } \rho_L. \quad (23)$$

$$\langle \Psi | O_i | \Psi \rangle = \text{Diagram 1} = \text{Diagram 2}. \quad (24)$$

Environment tensor recursion relation:

$$E(n+1) \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \end{array} \alpha = E(n) \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \end{array} \alpha + \sum_{\beta < \alpha} E(n) \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \end{array} \beta \begin{array}{c} \text{---} \\ \text{---} \\ \text{---} \end{array} \alpha. \quad (25)$$

Big diagram:

$$|\Psi\rangle = \text{---} \bigcirc_{A_1} \text{---} \bigcirc_{A_2} \text{---} \bigcirc_{A_3} \text{---} \dots \text{---} \bigcirc_{A_{N-1}} \text{---} \bigcirc_{A_N} \text{---} . \quad (26)$$

Inline diagram: $|\Psi\rangle =$ 