Importance sampling of randomized measurements for probing entanglement

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ABSTRACT

We show that combining randomized measurement protocols with importance sampling allows for characterizing entanglement in significantly larger quantum systems and in a more efficient way than in previous work [1, 2]. A drastic reduction of statistical errors is obtained using classical techniques of machine-learning and tensor networks using partial information on the quantum state. In present experimental settings of engineered many-body quantum systems this effectively doubles the (sub-)system sizes for which entanglement can be measured. In particular, we show an exponential reduction of the required number of measurements to estimate the purity of product states and GHZ states. Our work also shows a reduction of statistical error when probing with importance sampling, highly entangled states produced in quantum simulation [3].

REFERENCES

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FIGURE

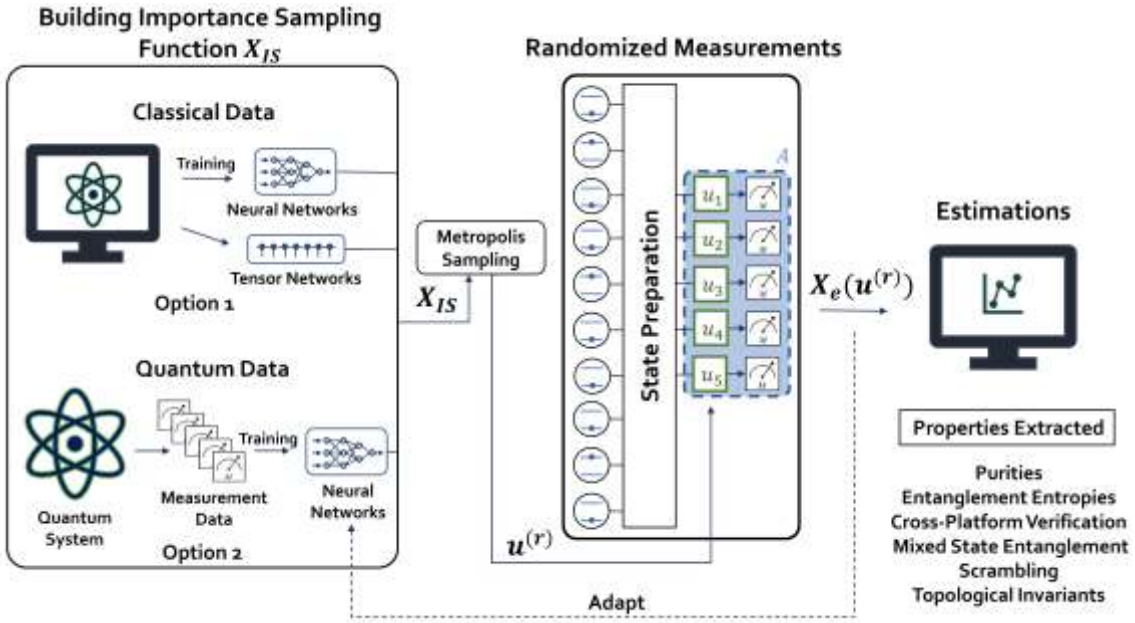

Figure 1: Randomized measurement protocol using importance sampling of local random unitaries.