

Deep Learning Application for Direct Measurement of $|V_{ts}|$ in Top Quark Decays from Dileptonic Top Pair Production at the LHC

The Cabibbo-Kobayashi-Maskawa (CKM) matrix governs flavor-changing quark interactions, with its element $|V_{ts}|$ describing the coupling between the top and strange quarks. Although the decay $t \rightarrow sW$ has not yet been observed directly, a measurement of $|V_{ts}|$ can be pursued by identifying strange jets produced in top quark decays. However, the relative rarity of $t \rightarrow sW$ compared with the dominant $t \rightarrow bW$ channel, coupled with the similarity of strange jets to other light-flavor jets, presents a significant experimental challenge. In this study, we explore the feasibility of measuring $|V_{ts}|$ in dileptonic top-quark pair events. We introduce DISAJA (Self-Attention for Jet Assignment with dilepton events), a deep learning model based on self-attention, designed to exploit both full event topology and detailed jet properties. By capturing the relationships among particles in an event, as well as the inherent characteristics of jets themselves, DISAJA demonstrates a powerful capacity to distinguish strange jets from top quark decays. We then present the model's projected performance for measuring $|V_{ts}|$ by identifying jets originating from $t \rightarrow sW$.

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