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## <sup>4</sup> **Scalar Neural Network Field Theory**

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Neural Network (NN) architectures at initialization define field theories. Certain large width limits of architectures result in free field theories due to Central Limit Theorem (CLT); deviations from CLT via finite width, and correlated, dissimilar NN parameters turn on field interactions. Edgeworth method provides a way to construct NN field theory actions using connected Feynman diagrams, where internal vertices correspond to connected correlators of NN field theories. Further, specific interacting field theories can be engineered via the NN parameter framework, where non-Gaussianities due to statistical independence breaking of NN parameters tune the action deformations. As an example, I will present the construction of <sup>4</sup> scalar field theory in infinite width NNs.

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