# Notes on Probabilistic Diffusion Models

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## Introductory Notes

Diffusion models are generative models which implies that they model/generate data similar to the data on which they were trained. Fundamentally, the diffusion models work by removing information from the training data in iterative fashion through the successive addition of Gaussian noise and then learning to approximate some of the lost information by reversing the noising process.

After training, the diffusion model can be used to generate data by simply passing randomly sampled noise through the denoised process with learned parameters.

In mathematical terms, a diffusion model is a latent variable model which maps to the latent space using a fixed Markov chain. This chain adds noised to the data in order to obtain the approximate posterior , where are latent variables of the same dimensionality as .



Figure: Markov chain constructed from image as data source

## References

[Introduction to Diffusion Models for Deep Learning, Ryan O'Connor, 2022 (online blog)](https://www.assemblyai.com/blog/diffusion-models-for-machine-learning-introduction/)

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[Tutorial on Diffusion Models for Imaging and Vision, Stanley Chan, 2024](https://github.com/dimitarpg13/information_theory_and_statistical_mechanics/blob/main/literature/articles/generative_models/Tutorial_on_Diffusion_Models_for_Imaging_and_Vision_Chan_2024.pdf)

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