

Analysis and Application of Diffusion Models in Communications

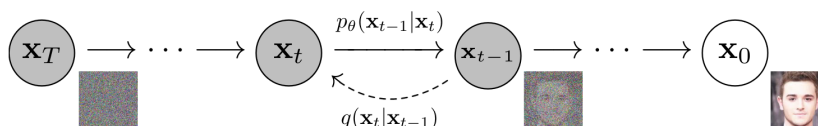
Master's Thesis

Project

After having revolutionised many fields in science and engineering, Machine Learning (ML) techniques have recently found their way into the physical layer of communication systems. "Classical" model-based algorithms had set the bar very high regarding performance and complexity, but new algorithms are necessary to meet the increasing bandwidth demands of future communication systems.

In the past years, research in machine learning has made enormous progress, especially in the field of generative models. In between the various concepts, recently, diffusion models have attracted attention due to their interesting properties. Based on denoising processes, diffusion models combine flexibility and tractability. However, they have not been studied widely in communications engineering so far.

This thesis involves the analysis of diffusion models and their applicability in communications engineering as well as the implementation of suitable approaches. This also includes a thorough evaluation for different communication scenarios and, therefore, the integration into a flexible simulation environment.



Tasks

1. Analysing diffusion models and possible applications
2. Implementing suitable approaches
3. Building up a simulation platform
4. Optimising and analysing the concept in different scenarios

Requirements

- ✓ Experienced in programming (preferably Python, PyTorch)
- ✓ Good knowledge of machine learning and optimisation (MLOC)
- ✓ Knowledge of communication basics and equalisation (CE2/NT2, SigNT)

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