"Molecular communications: Model-based and data-driven receiver design and optimization"

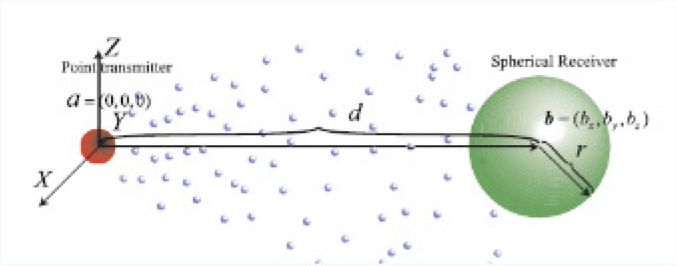
Introduction

In this project, we tried to derive the impact of inter-symbol interference and analyze the performance of different threshold-based receiver schemes. The aim of this paper is to analyze and optimize the receivers by using the conventional model-based approach, which relies on an accurate model of the system, and the emerging data-driven approach, which, on the other hand, does not need any apriori information about the system model and exploits deep learning tools.

System Model

The channel considered in the article works on the Fick's second law of diffusion i.e. the molecules will moves towards the less concentration from the higher concentration. It uses CSK (Concentration Shift Keying).

It shares (on-of shift keying) to transmit information particles towards the receiver. Also the the diffused particles follow Brownian motion and moves randomly and independently. This creates the interference between the molecules reaching at different time slots. This interference is known as Inter Symbol Interference(ISI) and we try to model different threshold based receivers to identify correct transmitted bit and lower BER.

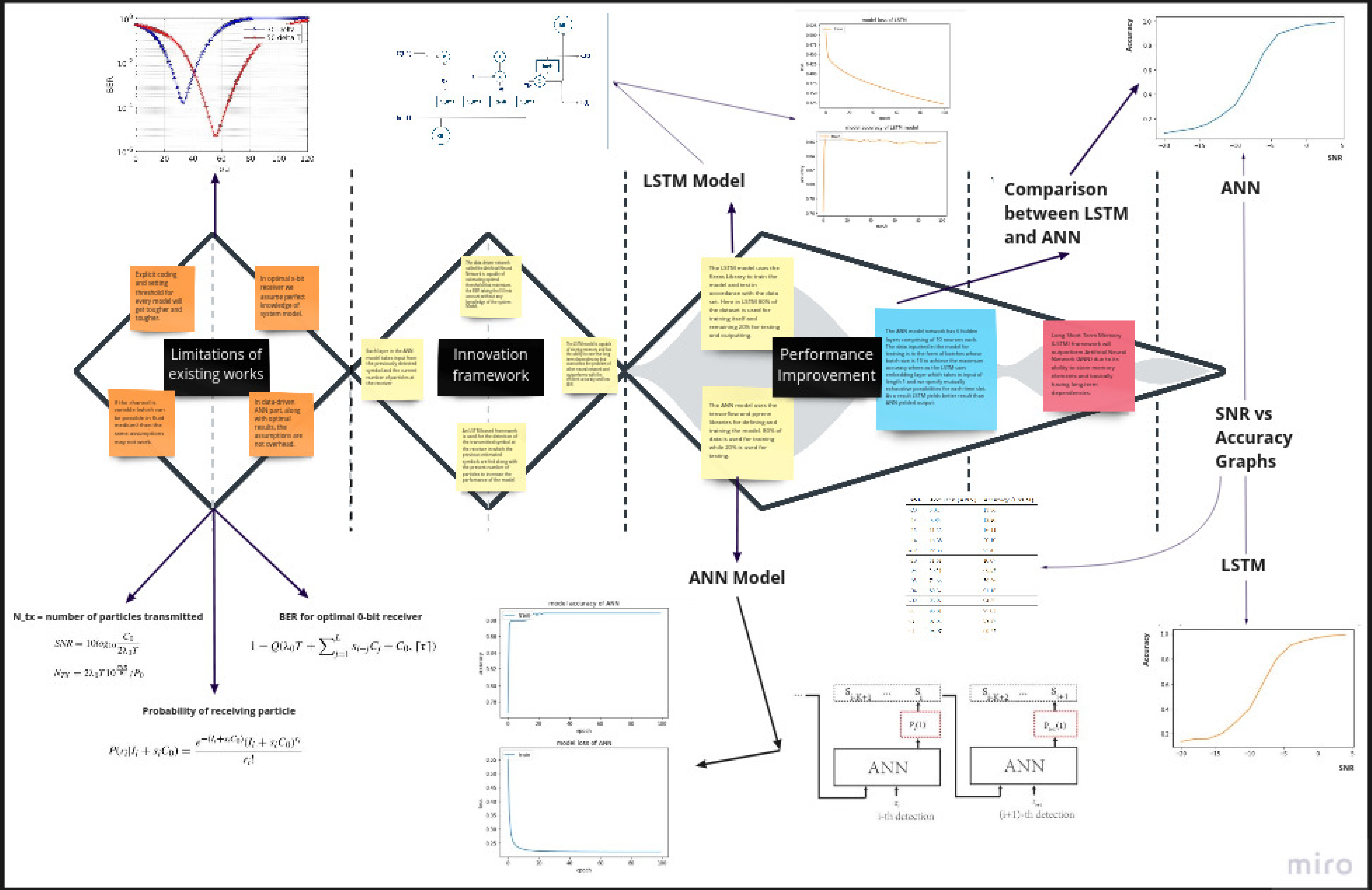


What we have done so far

- We introduced a new analytical framework to compute the BER of a MC system that uses threshold based demodulators.
- By modeling the receiver as an ANN, in addition, we proved that data-driven receivers provide similar performance as those that are optimized based on the exact knowledge of the channel model.
- We have shown that the resulting ANN architecture results in a threshold-based receiver whose threshold coincides with that predicted theoretically.
- Now, we are going to introduce a new framework that can increase the performance than of the existing ANN architecture.

Resources

X. Qian, M. Di Renzo, and A. Eckford, "Molecular communications: Model-based and data-driven receiver design and optimization."IEEE Access, vol. 7, pp. 53 555-53 565, 2019.



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