

# Machine Learning Autoencoder Applied to Communication Channels

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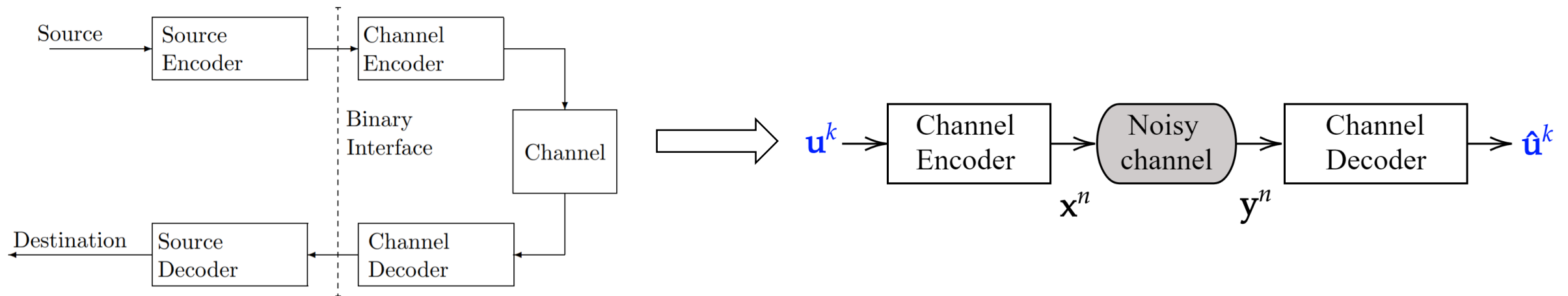
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# Summary

- Introduction
  - Point to point communication system
  - Binary symmetric channel
  - Channel decoding: Maximum A Posteriori Decoder (MAP)
- Problem Statement
- Related Work
- Future Work

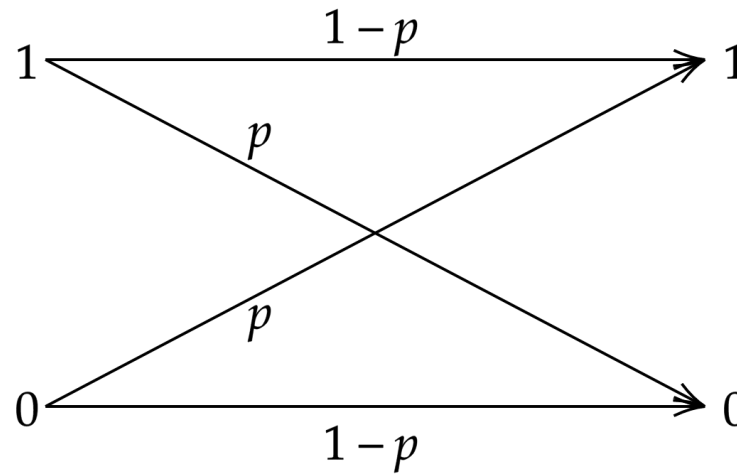
# Introduction

- Point to point communication system



# Introduction

- Binary symmetric channel



- Cross over probability  $0 \leq p \leq 1/2$
- Result in *corrupted* information

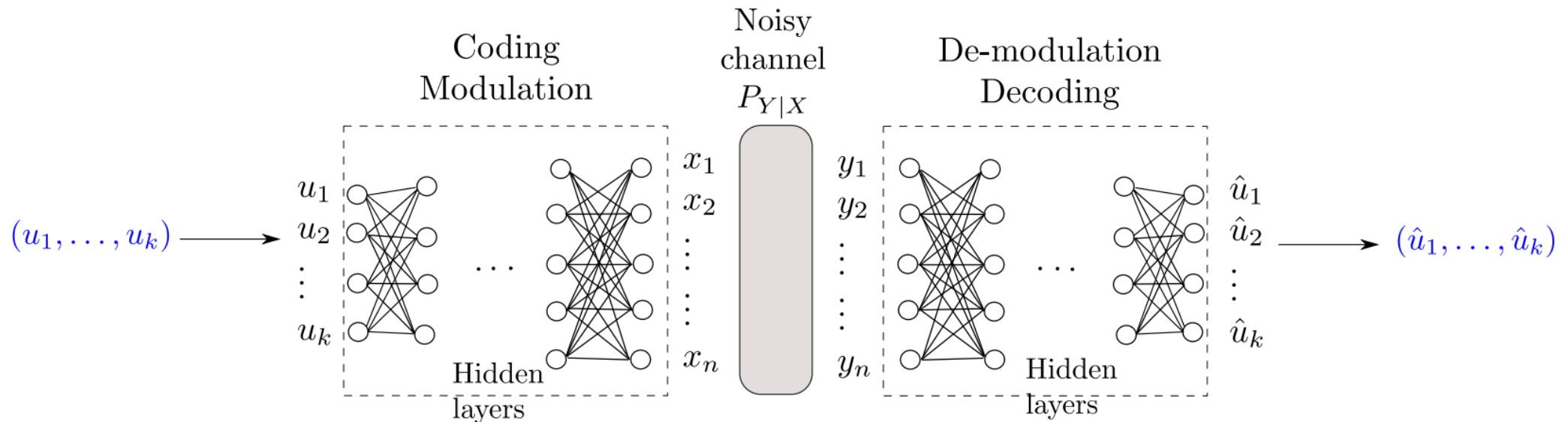
# Introduction

- Channel decoding: Maximum A Posteriori Decoder (MAP) Rule
  1. Given the channel output code word  $y^n \in \{0,1\}^n$
  2. Assume a joint distribution between the input and the output
  3. Choose a value for the input code word that maximizes the probability of having the observed output

$$f(y) = \arg \max_{x \in \mathcal{X}} P_{X|Y}(x|y)$$

# Problem Statement

- Proposed solution: Deep Neural Network (DNN) based Autoencoder



# Related Work

- O'Shea et al. develop a fundamental new way to think about communications system design as an **end-to-end** reconstruction optimization task that seeks to jointly optimize transmitter and receiver components in a single process, by interpreting a communications system as an autoencoder. <sup>1</sup>
- T. Gruber et al. proved that a deep learning-based channel decoder could actually learn a decoding algorithm rather than just being a simple classifier. <sup>2</sup>

# Future Work

- Machine Learning
    - DNN basics ✓
    - TensorFlow library familiarization -
    - DNN channel decoder X
    - DNN channel autoencoder X
  - Results X
  - Analysis X
  - Conclusions X
- Communication System
    - Hamming source code ✓
    - MAP channel decoder ✓
    - BER x SNR graphics X