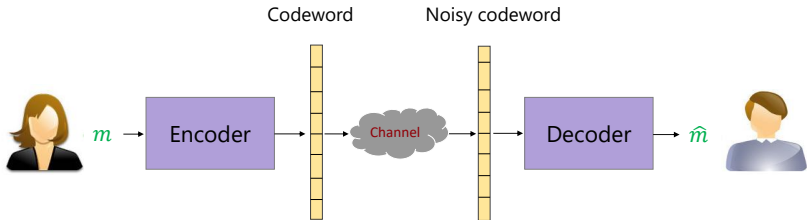


# **KO codes: inventing nonlinear encoding and decoding for wireless communication via deep-learning**

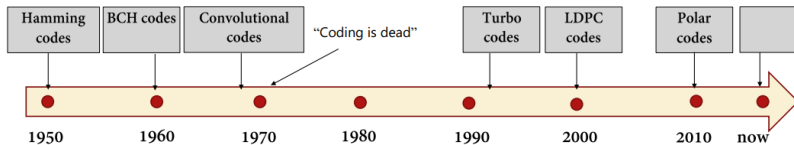
**ICML 2021**

Ashok Vardhan Makuva\*, Xiyang Liu\*, Mohammad Vahid Jamali, Hossain Mahdavi, Sewoong Oh, Pramod Viswanath

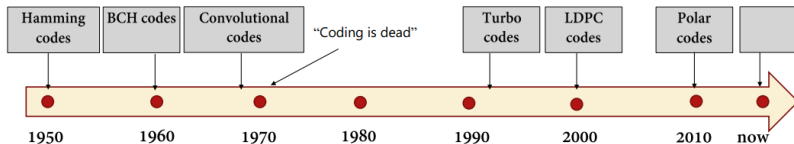
# Main goal



# Classical methods

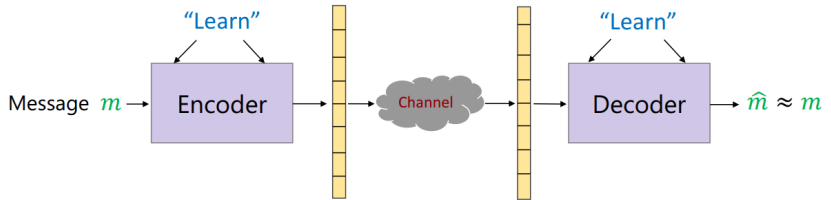


# Classical methods



- Can we invent new state-of-the-art codes using deep-learning?

# Inventing codes



# Code Structure

- Linear: Classical codes

# Code Structure

- Linear: Classical codes
- Non-linear: Neural networks

# Code Structure

- Linear: Classical codes
- Non-linear: Neural networks
  - Fully connected networks worse than trivial codes (Jiang et. al '19)
  - **Still need a structure**

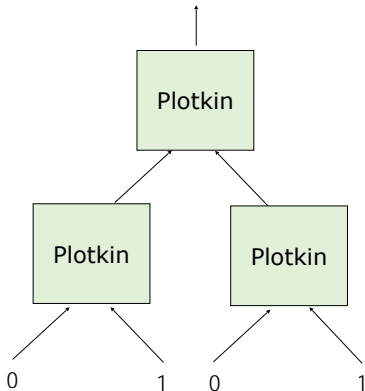


# Code Structure

- Linear: Classical codes
- Non-linear: Neural networks
  - Fully connected networks worse than trivial codes (Jiang et. al '19)
  - Still need a structure
- KO neural networks  $\leftrightarrow$  KO codes

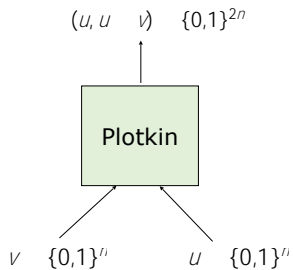
# KO neural networks

- Encoding of Reed-Muller/Polar codes



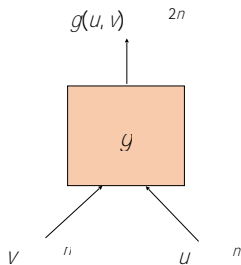
# KO neural networks

- Plotkin block



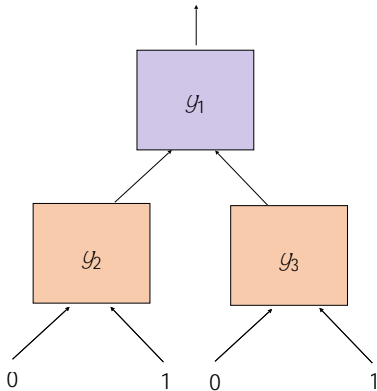
# KO neural networks

- KO block



# KO neural networks

- KO neural network



# Performance of KO codes

Code-dimension=46, Block length = 512.

