Channel Resolvability Codes based on Sparse Random Linear Coding

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joint work with Gerhard Kramer

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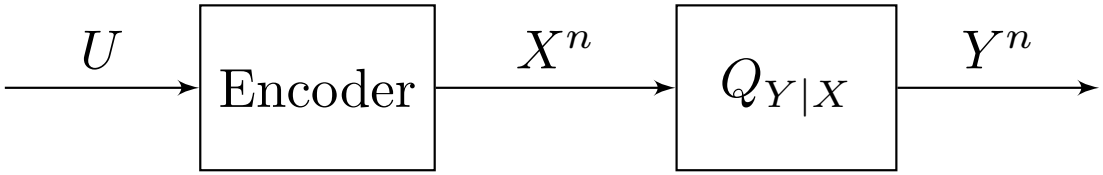
Channel Resolvability



- **Aim:** Approximate Random number generation at the output of a channel.
- **Appr. Measures** Informational divergence, Normalized informational diveregence, Variational distance.
- **Applications:** Secrecy, Stealth, Coordination.

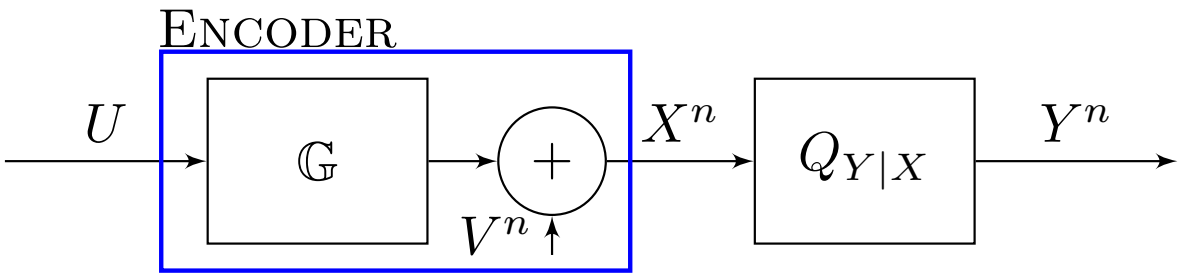
Achievability and Converse

A rate R is said to be achievable if there exists an encoder such that

$$\mathbb{D}(P_{Y^n} \| Q_Y^n) \overset{n\to\infty}{\longrightarrow} 0$$

- **Converse:** No rate $R < I(X;Y)$ achievable.
- **Achievability:** Any $R > I(X;Y)$ achievable.
  - Proved using random coding arguments.
  - Code design with reasonable complexity is still largely an open problem.

Random Linear Coding (RLC)



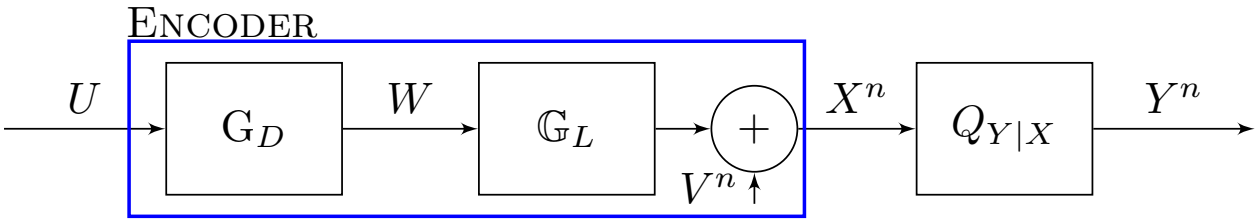
Encoder Operation

$$X^n = U\mathbb{G} \oplus V^n$$

$\mathbb{G}$ is a $nR \times n$ random binary matrix.

- We showed that any $R > I(X;Y)$ is achievable using RLC.
- The encoding complexity is $\mathcal{O}(n^2)$.

Sparse Random Linear Coding



Encoder Operation:

$$X^n = W\mathbb{G}_L \oplus V^n$$
$$W = U\mathrm{G}_D.$$

G_L is a known $nR \times f$ binary matrix, $\mathbb{G}_L$ is a $f \times n$ sparse random binary matrix.

- We showed that any $R > I(X;Y)$ is achievable using sparse RLC.
- Encoding complexity $\mathcal{O}(n \log n)$ is achievable.

Thank you