Hamming Codes

Lecture 3

9/9/15

Recall the following parity check matrix for Hamming Codes:

$$H = \begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

1. Encode message $\vec{m} = 1011$

2. Decode $\vec{s} = 1011000$

What if we use the following parity check matrix to construct a Hamming Code:

$$\begin{pmatrix} 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 \end{pmatrix}$$

1. Encode message $\vec{m} = 1011$

2. Apply error correction and decode $\vec{s} = 0111100$

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Discussion:

- What happens if we want to encode a 3-bit message? A 5-bit message? An 11 bit message?
- What is the rate of the Hamming code?
- How many errors can be detected with the Hamming code?

Challenge: Construct a Hamming Code for encoding messages of length 5

- What is the parity check matrix?
- Show how to encode the message $\vec{m} = 10101$
- Apply error correction and decode $\vec{s} = 110010001$