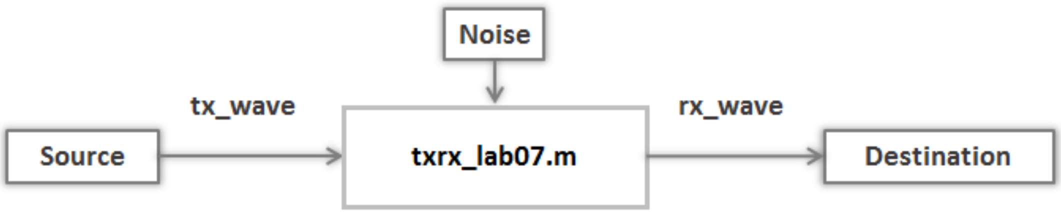
Help

LAB 8 TASK 3 - BER WITH VARYING BIT TIME

In this task, you will study the effect of bit time (SPB) on the BER performance of a communication system over a noisy channel.




```
distance = 8;               % set the transmission distance
tx_bs = rand(1,1280)>0.5;   % generate a random bit sequence

SPBlist = [50 20 10];       % list of bit times in samples
num_SPB = length(SPBlist);
for i = 1:num_SPB
    SPB = SPBlist(i);
    tx_wave = format_bitseq(tx_bs,SPB); % create waveform following protocol
    % transmit and receive over noisy channel
    [rx_wave,start_ind,rx_min,rx_max,sigma] = txrx_lab07(tx_wave,distance);
    sample_ind = start_ind+2*SPB-1+SPB*[0:1279];
    thresh = 0.5*(rx_max+rx_min);               % set threshold
    decoded_bs = rx_wave(sample_ind) > thresh; % decode bit stream

    empBER = compute_BER(tx_bs,decoded_bs);  % compute BER
```

Correct

Figure 1

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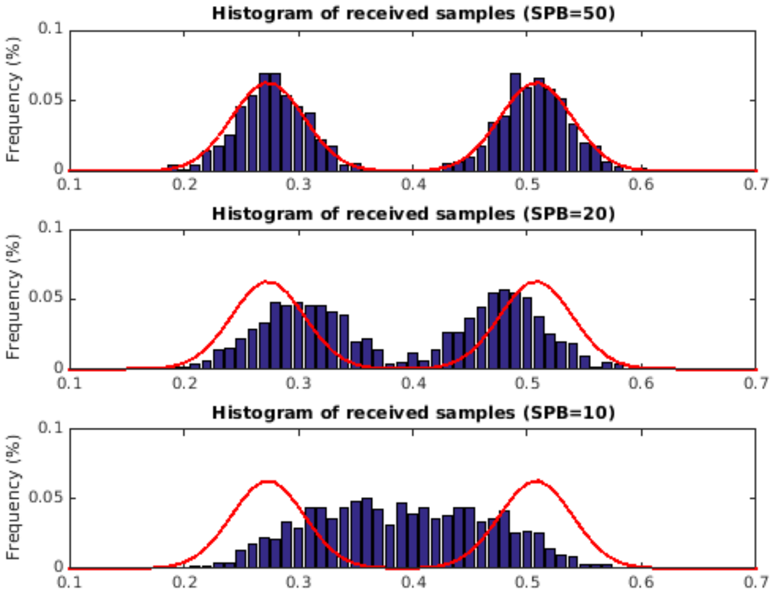

At bit time 50 samples, the predicted BER is 0.00010542 and the empirical BER is 0.
At bit time 20 samples, the predicted BER is 0.00010542 and the empirical BER is 0.0078125.
At bit time 10 samples, the predicted BER is 0.00010542 and the empirical BER is 0.10547.

Check Reset Save Hide Answer *You have used 1 of 10 submissions*

INSTRUCTIONS

Run the code in the code window. The code simulates communication over the noisy channel for three different bit times: 50 SPB as used in previous tasks, as well as shorter bit times of 20 and 10 SPB.

The code plots the empirically estimated histograms of the values of the received signals, as well as the theoretically predicted histograms assuming the four simplifying assumptions made in Topic 8.2 in order to make the mathematical analysis more tractable:

1. Perfect synchronization.

2. Single sample decoding

3. No ISI

4. Additive white Gaussian noise

It also estimates the BER from the simulated measurements, and compares the results to the theoretical predictions.

Unlike the previous tasks, you will observe a mismatch between the theoretical predictions and the simulation results. Think about why this is occuring, and answer the two questions below. There is no coding work for this task.

LAB 8 TASK 3 - QUESTION 1 (1/1 point)

As we decrease the bit time, what trends do you observe in the empirically measured and theoretically predicted BER?

Please select the correct answer.

- Both empirical and predicted BER remain unchanged.
- The empirical BER increases, but the predicted BER remains unchanged. ✔
- The empirical BER remains unchanged, but the predicted BER increases.
- Both empirical and predicted BER increase

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EXPLANATION

The theoretically predicted BER is unchanged as the bit time decreases, since it depends only upon the values of r_{max}, r_{min} and σ, which are estimated from the training sequence. For an explanation of why the empirical BER increases, see the next question.

Final Check | Save | Hide Answer | *You have used 1 of 2 submissions*

LAB 8 TASK 3 - QUESTION 2 (1/1 point)

In Topic 8.2, in order to analyze the BER mathematically, we made the four simplifying assumptions shown below. In our previous tasks, we observed good agreement between the theoretically predicted and empirically measured BER values. However, this is not the case in this task. Which of the simplyfing assumptions has been violated in this situation?

Please select the correct answer.

- Perfect synchronization
- Single sample decoding
- No ISI ✔
- Additive white Gaussian noise

EXPLANATION

As the bit time decreases, the amount of ISI increases. This causes additional variability in the responses to 0 and 1 bits, based upon the past bits transmitted. The new responses to the 0 bit introduced by ISI are generally higher than r_{min}. Similarly, the new responses to the 1 bit are generally lower than r_{max}. This caused the closing of the eye. This is reflected in the histogram by a broadening of the histograms of the responses to 0 and 1 bit, and their eventual merging.

Final Check | Save | Hide Answer | *You have used 1 of 2 submissions*

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