C Tech Information Technologies Inc.

Summer Internship

16/07/2024 - 22/07/2024

Week 4 Report:

22/07/2024

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Purpose:

The purpose of this document is to provide an overview of my fourth and last week's activities during my internship. I aim to document the tasks I was responsible with, the skills I learned, and my experiences in my last week at the company.

Introduction:

I intern at the “Communications System Design” department within the company. The department consists of 4 engineers and myself as an intern. My final week had passed with implementing some more digital communication terms and making simulations of them as well as finalizing and reviewing what I’ve done so far in my internship.

Work Done:

At the start of the week, my supervisor tasked me with creating a matlab module that would visualize the algorithm for detecting the header via correlation. In order for this to happen, I had to modify the previous coding I did for the header detection. Also, I created a new module that would give the correlation output for a long dataset and a header. The output would basically be the correlative output in this module **(Appendices 1&2)**.

Then my supervisor had tasked me with searching what gold coding was. It was basically a type of binary sequence used in communication systems. They were pseudo-random sequences generated using linear feedback shift registers. Also, their cross-correlation properties were excellent for a header, gold codes' correlation with themselves were low.

Then after learning what gold code was, I tried to implement them on matlab and finally managed to successfully create a function that took no inputs but gave a specific 31-bit binary gold sequence as output **(Appendix 3)**. I would later on use this gold sequence header from now on.

Then I updated the already existing function named test.m **(Appendix 4)** in order to get the correlative output and the detection&error counts for each package series. Instead of a single output for test.m, I added four more outputs. test.m now gave not only the errorrate of the packages, but also the correlation process's output which the module already calculated partially within itself.

Then I wrote another module to simulate my results **(Appendix 5)**. This module tested different SNR values and plotted the correlative output. Here you can see the correlative output plotted on y-axis and the bit number on the x-axis. Legend of the graphs contain the package error and header detection errors. **(Figures 4.1 to 4.5)**

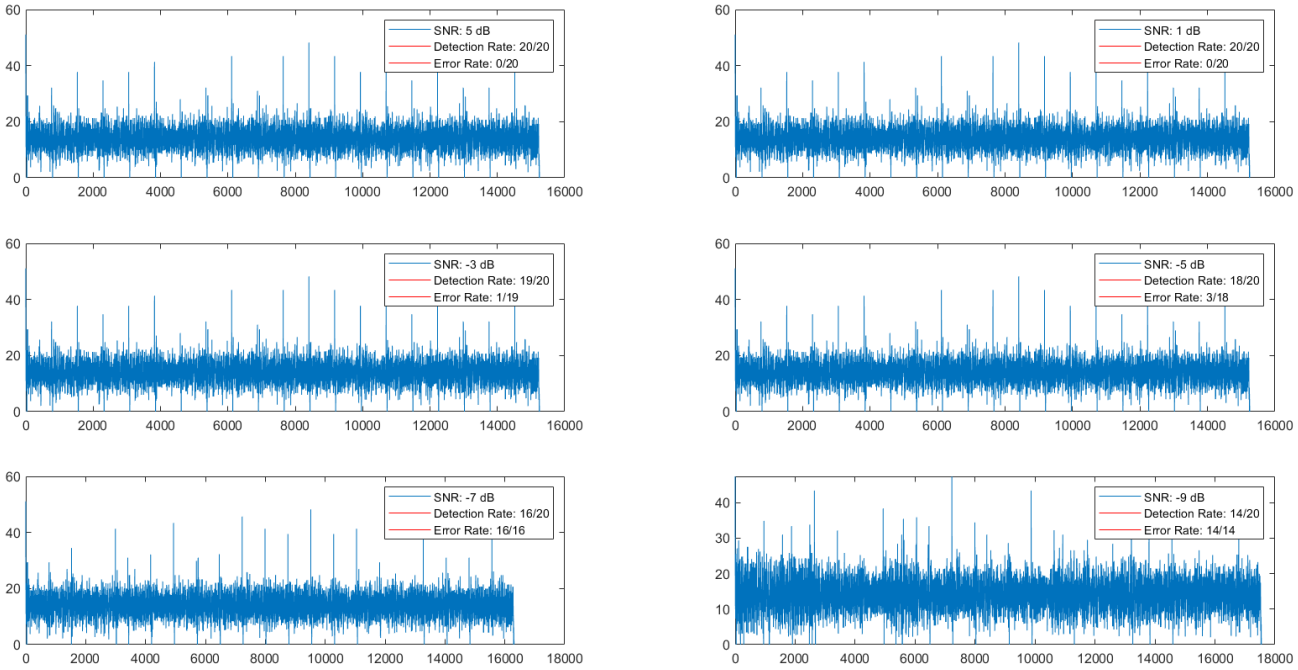

Figure 4.1: FEC:Repetition by 1/3; Packagenumber=20; SNR's = [5, 1, -1, -5, -7, -9]

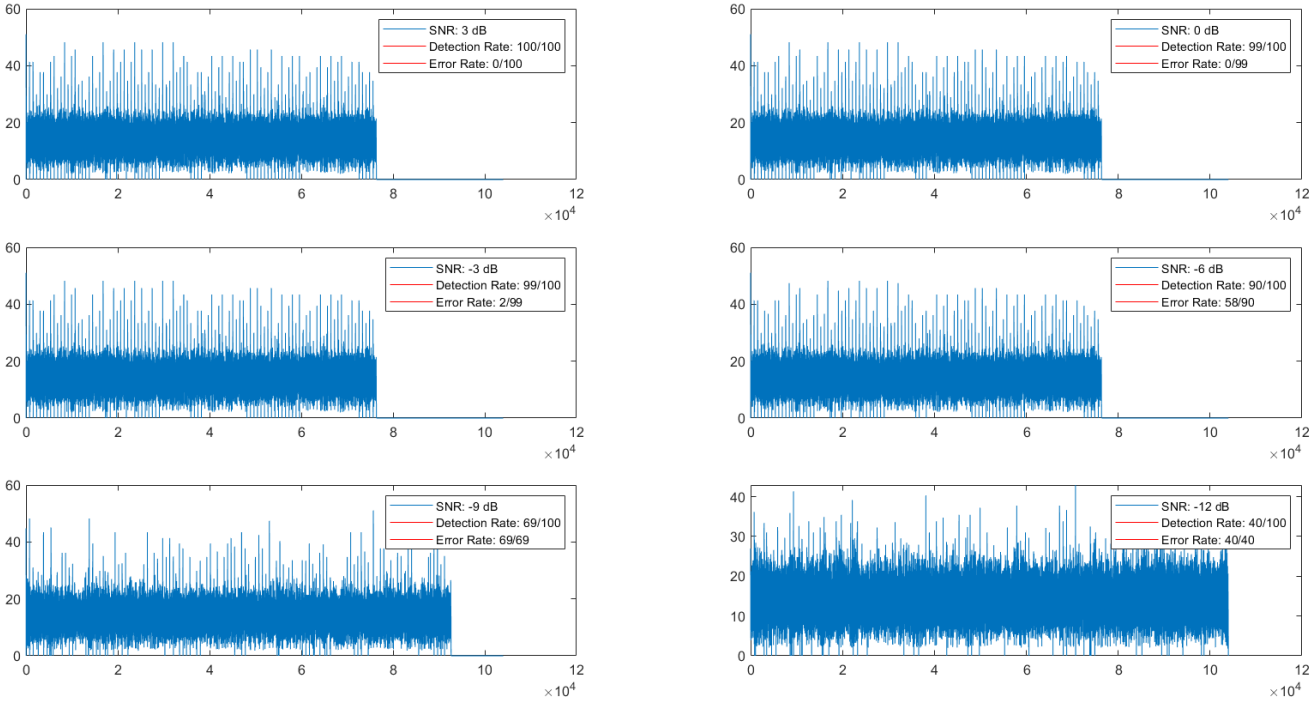

Figure 4.2: FEC:Repetition by 1/3; Packagenumber=100; SNR's = [3, 0, -3, -6, -9, -12]

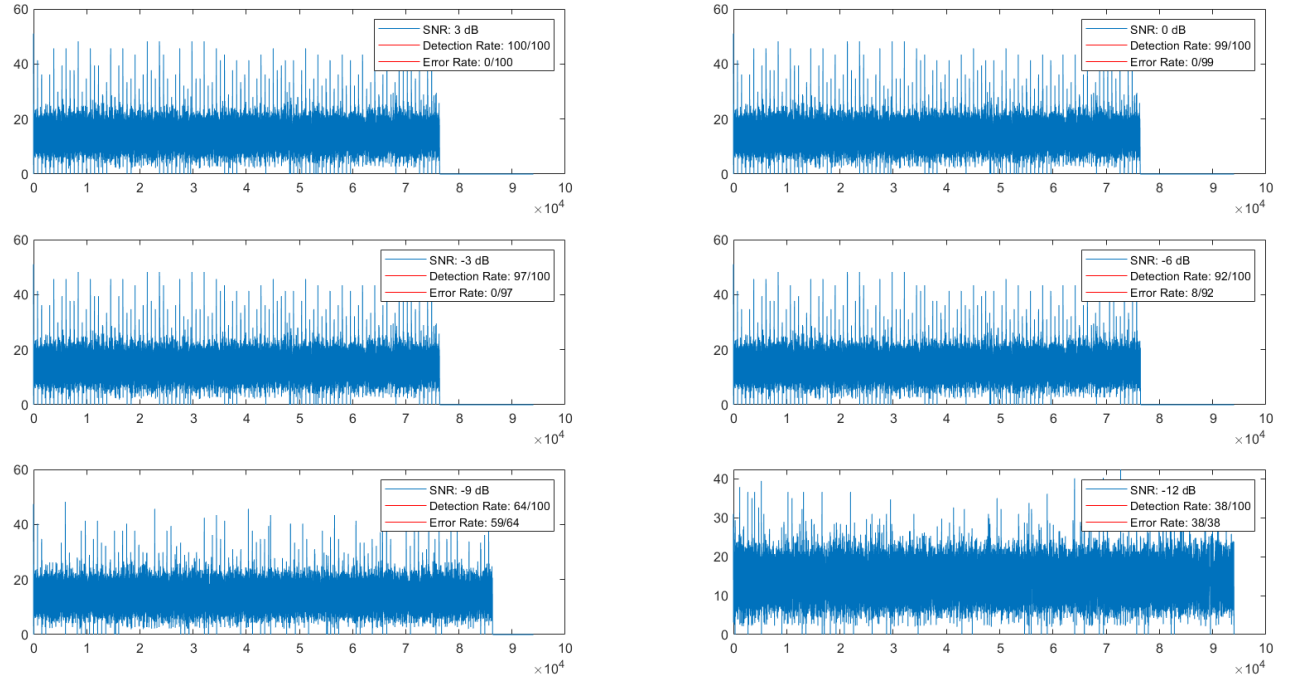

Figure 4.3: FEC:Convolution by 1/3; Packagenumber=100; SNR's = [3, 0, -3, -6, -9, -12]

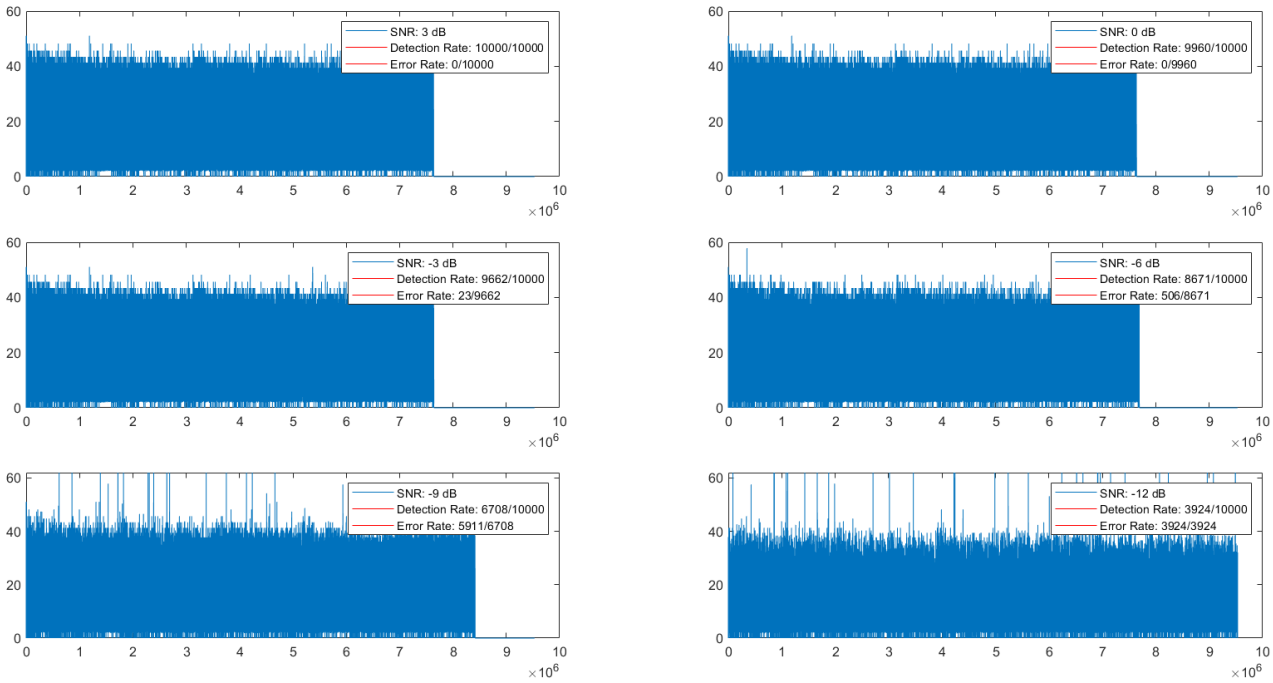

Figure 4.4: FEC:Convolution by 1/3; Packagenumber=10000; SNR's = [3, 0, -3, -6, -9, -12]

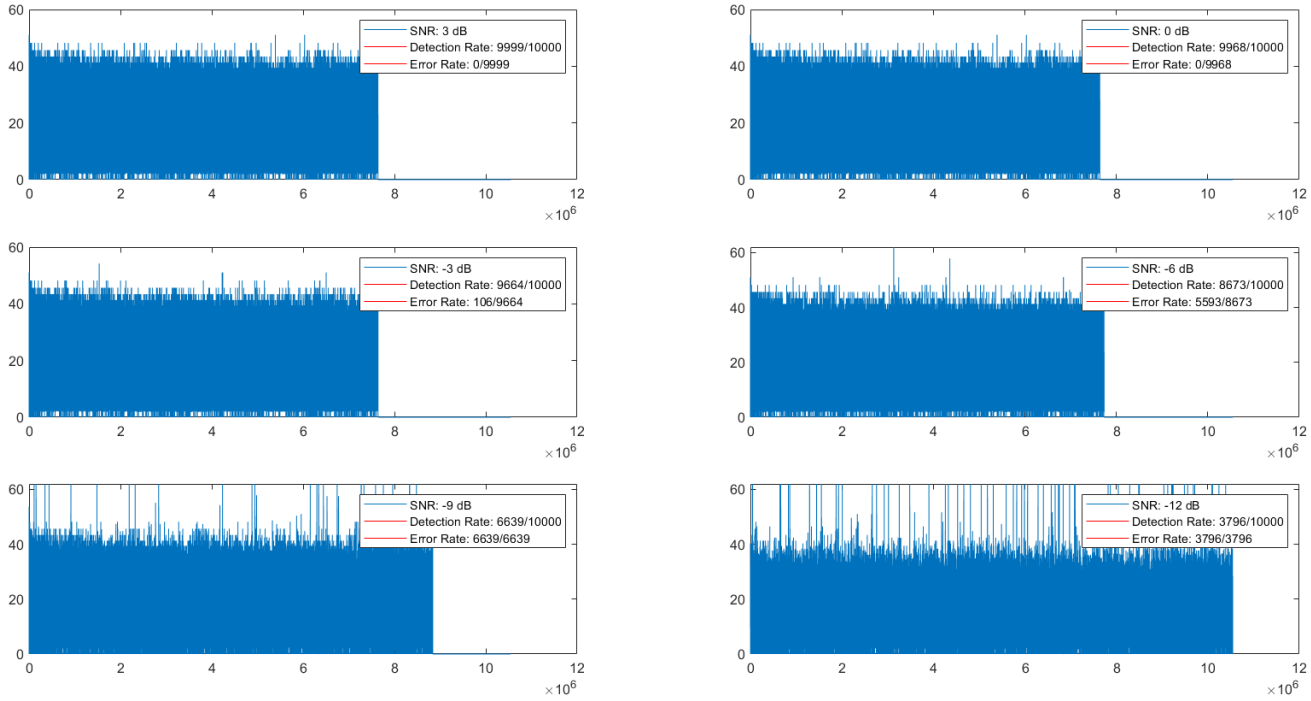

Figure 4.5: FEC:Repetition by 1/3; Packagenumber=10000; SNR's = [3, 0, -3, -6, -9, -12]

From these graphs we can conclude that as SNR goes down, both the detection rate and the package error rate within detected packages go significantly down. Also, changing the forward error correction type, does have an effect on the package error rate but not on the detection rate. Detection rate gets affected by SNR only in this case.

Conclusion:

My final week had passed with implementing some more digital communication terms and making simulations of them as well as finalizing and reviewing what I've done so far in my internship. I believe this final week really contributed to my software simulation tools skills as well as my theoretical information on digital communication systems.

I think my 4-week internship was really useful to me both in my technical skills as well as my personal characteristics and observations on a work-environment in a company which consists of almost 250 engineers. C Tech Information Technologies Inc. is not a big-tech company but also it is not a start-up. These levels of medium sized companies are also called scale-up companies. I believe conducting an internship in this medium sized company which is not fully corporate and also not fully intimate really helped me in so many ways.

Appendices:

1. https://github.com/fmcetin7/CTech-Internship/blob/main/week4matlacodes/detectheader.m
2. https://github.com/fmcetin7/CTech-Internship/blob/main/week4matlacodes/calculatecorr.m
3. https://github.com/fmcetin7/CTech-Internship/blob/main/week4matlacodes/goldcodegenerator.m
4. https://github.com/fmcetin7/CTech-Internship/blob/main/week4matlacodes/test.m
5. https://github.com/fmcetin7/CTech-Internship/blob/main/week4matlacodes/snrtest.m