CMPT 318 – CYBER SECURITY

DR. UWE GLASSER, FALL 2021

ASSIGNMENT 2.

**1. Answers:**

Feature scaling is an essential preprocessing technique of input data for machine learning algorithms and beyond. Two widely used feature scaling techniques are normalization and standardization. For each of the following questions explain clearly and concisely:

1. What is feature scaling?

* Feature scaling is a type of modeling that helps raw data that a human can understand be transformed into an input set of data that can be understood by a machine.
* Feature scaling also helps us converge data easier because of proper scaling.

1. Why scaling features of a dataset is necessary?

* Gives us an insight of how the data behaves relative to a number, this not just makes it easier for a person to see certain patterns, normalization or standardization of data makes it easier for a machine to also detect anomalies in the system.
* Clustering algorithms (Machine Learning) will fail as they will be skewed by different (not standardized nor normalized) scales as they rely on distance metrics.

1. What does normalization and standardization do to the data and the noise? Your answers to all three questions should not exceed 2 pages in total but provide technical descriptions including the use of mathematical notation.

**2):**

**MODEL DATA SET.**

This set of data seems to be consistent with the flow of the output for the global intensity.

Some model numbers:

Week 1 to Week 10 (excluding week 8)

Mean range: [5.5,6.5]

Median range [5.5,5.7]

Sd range: [4.3,4.9]

From the dataset the most anomalous weeks are the following:

The following are SMA (10 minutes):

**WEEK 8:**

**Chart, histogram

Description automatically generated**

**Mean: 2.39**

**Median: 1.38**

**Sd: 2.462335**

**Chart

Description automatically generatedWEEK 31: WORST ONE**

MEAN: 1.631661

MEDIAN: 1.26

SD: 1.185286

WEEK 43:

Chart, histogram

Description automatically generated

Mean:3.286136

Median: 2.26

SD: 2.931347

Week 44:

Chart, histogram

Description automatically generated

Mean: 4.506277

Median: 2.42

SD: 4.491641

Median here as you can see is around 2.42 because of the data being weirdly cut, also SD score is normal.

Week 52:

Chart, histogram

Description automatically generated

Mean: 5.196453

Median: 5.48

SD: 3.915592

As you can see at the plot is questionable for 3 days.

3. Given a Hidden Markov Model, or HMM, as defined in the tutorial introduction by Rabiner, there are three basic problems of interest to be solved for a model used in real-world applications.

Based on your understanding from reading the tutorial introduction clearly and concisely explain in plain English words the meaning of Problem 1 for detection of anomalous patterns in stream data from a continuously operating system, such as a supervisory control system, i.e. what does refer to in terms of intrusion detection in this application context.

Given here the