*Implement Anomaly Detection Sample*

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*Abstract*—Anomaly detection in sequential data is essential for industrial monitoring, predictive maintenance, and fault detection. This study demonstrates the application of hierarchical temporal memory (HTM) via the NeocortexAPI to detect anomalies in temporal sequences, leveraging the Multi Sequence Learning framework. // This study explores the use of Neo Cortex API for learning multiple sequences and predicting anomalies by detecting deviations from expected patterns. This paper presents an anomaly detection framework using Neo Cortex API, demonstrating the learning and prediction of multiple sequences. The proposed approach utilizes Multi Sequence Learning to train on sequences and employs the Predictor class to infer the anomalous values. The system operates autonomously, logging both predicted and observed values in real time, displaying them on the screen, and storing them in a CSV file. A graphical representation of the results is provided for analysis. The results demonstrate how predictive modeling can effectively identify unexpected deviations in sequential data

Keywords—Anomaly detection, hierarchical temporal memory (HTM), Multi Sequence Learning, Neocortex API

# INTRODUCTION

# Anomaly means something that deviates from what is standard, normal, or expected. Anomaly detection refers to the problem of finding anomaly patterns in data(will add reference here <https://ieeexplore.ieee.org/document/7836799>.

Anomaly detection algorithms can be classified in respect to different criteria. We can roughly classify them into two categories: spatial data and sequential (temporal) data, based on whether data instances have sequential (temporal) components.

# Methods

## Data Collection and preprocessing

## MultiSequence Learning and Predictiony

## Implementation

# ANOMALY PATTERN DETECTION

# Results

## Anomaly Detection Performance

## Graphical Representation

# Discussion

Conclusion of your work should be precise and concise. How was the project, what is done, what is the result... There can be discussion on further work and direction.

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Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

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may use the solidus ( / ), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

*a**b* 

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

## Some Common Mistakes

* The word “data” is plural, not singular.
* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
* A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).
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* Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
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* There is no period after the “et” in the Latin abbreviation “et al.”.
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For adding object other than text (tables, equations, graphs, figures, code…), **there must be at least one cross reference** to it. Figure 1 is an example

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1. Table Type Styles

| Table Head | Table Column Head | | |
| --- | --- | --- | --- |
| Table column subhead | Subhead | Subhead |
| copy | More table copya |  |  |

1. Sample of a Table footnote. (*Table footnote*)



Figure Example Figure Caption

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

## Code References:

Referencing Code in your text should be avoided unless necessary. In such cases it can be inserted as a listing as shown in **Error! Reference source not found.**

Listing Code Reference Example

Console.WriteLine(“Referencing code”, var);

// using tab can be replaced with 4 spaces

Do not pass code as image. When referring to variable in **Error! Reference source not found.**, italics should be used for example *var.* Code flows and logic should be presented better as Graph or Diagram instead of words.

Code Block which is too big to put in the textbox can be reference as Listing 2.

Listing Unit Test [EncodeDateTimeTest](https://github.com/ddobric/neocortexapi/blob/0348ffb99739ddf8c8c3a875f8162a18073938ca/source/UnitTestsProject/EncoderTests/DateTimeEncoderExperimentalTests.cs#L34-L49)

public void EncodeDateTimeTest(int w, double r, …)

{

…

DateTimeEncoderExperimental encoder = new…

var result = encoder.Encode(input);

…

Assert.IsTrue(result.SequenceEqual(expected…

}

##### Acknowledgment *(Heading 5)*

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

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7. M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 1989.

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