
VILNIUS UNIVERSITY
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DEPARTMENT OF COMPUTATIONAL AND DATA MODELING

Bachelors Thesis

# Implementation of application for visualization of regularities and randomness in data

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# Contents

# Keywords

Pateikiamas terminų sąrašas (jei reikia)

# Abstract

Santraukos tekstas rašto darbo kalba...

# Santrauka

## Darbo pavadinimas kita kalba

This is a summary in English...

# Introduction

Signals can be observer all around us. For example, measuring the time taken between a weight-driven pendulum clock's ticks produces a signal. It does not require a great deal of effor to image how such a signal behaves. We would expect the clock's pendulum to swing back and forth, each time travelling a minutely shorter distance until the pendulum stops completely. Analysis of even a part of such a signal can help us determine the pendulum's position far into future.

Now consider a more complex siganl: the rates of a stock market. People have been analyzing this data for decades, grasping to predict its future state. For the scope of this paper, we defined the term signal processing as *the science of analyzing time-varying processes* [1].

In this thesis we analyzed the non-triviality of digital sygnals. Certain signals can be classified as simple (relatively trivial), like the aforementioned clock's pendulum. A more complex (non-trivial) signal would be the rates of a stock exchange.

# 1 Signal processing and Recurrence plot

## 1.1 Signal processing

A signal is a function that conveys information about the behaviour of a system or attributes of some phenomenon [2]. For example, measuring the time taken between a weight-driven pendulum clock's ticks produces signal. In turn, for the scope of this paper, we defined the term signal processing as *the science of analyzing time-varying processes* [1]. By processing a signal we analyzed the non-triviality of a given signal. Analyzing a signal reveals that some signals have properties that can be categorized.

## 1.2 Signal property categories

We have considered the following categories:

1. Stationary and non stationary signals
2.

Signals have varying properties. Some consist of simple repetitions while others have no apparent patterns. For example, measuring the time taken between a weight-driven pendulum clock's ticks produces a relatively simple (trivial) signal.

# 2 Web application development

This project is aimed at creating a web application allowing one to interact with the recurrence plot algorithm in a user friendly manner. This is an effort to further spread the popularity of this algorithm and help users intuitively grasp how it behaves.

# 3 Pirmasis skyrius

## 3.1 Pirmojo skyriaus poskyris

Pateikiamas 3.1 poskyrio tekstas. Vienas iš šaltinių [**?**]. Visas [**?**] turinys priklauso 3 skyriui.

### 3.1.1 Pirmojo skyriaus pirmo poskyrio poskyris

Pateikiamas trečio lygio poskyrio tekstas.

$$x = \sum_{i=1}^{N} m_i \tag{3.1}$$

Table 1. Lentelė ...

| | |
|---|---|
| test | test |
| test | test |

Sprendimas pristatomas 1 algoritme, o įgyvendinimas -- 1 išeities kode.

**Algorithm 1.** Algoritmas uždavinio sprendimui

**Require:**
**Ensure:**
a **and** b

Listing 1. Pagrindinio metodo žingsniai

```
1 public static void main(String args[]){
2 }
```

# Conclusions and Recommendations

Išvados bei rekomendacijos.

# Ateities tyrimų planas

Pristatomi ateities darbai ir/ar jų planas, gairės tolimesniems darbams....

# References

[1] R.G. Lyons. *Understanding Digital Signal Processing*. Prentice Hall professional technical reference. Prentice Hall/PTR, 2004.

[2] R. Priemer. *Introductory Signal Processing*. Advanced Series In Electrical And Computer Engineering. World Scientific Publishing Company, 1990.

# Appendices

Dokumentą sudaro du priedai: A priede ....

# A Pirmojo priedo pavadinimas

Pirmojo priedo tekstas ...

# B Antrojo priedo pavadinimas

Antrojo priedo tekstas ...