Machine learning approach to support ticket forecasting from software logs

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Abstract

!!!Your abstract in English. Keep the abstract short. The abstract explains your research topic, the methods you have used, and the results you obtained. In the PDF/A format of this thesis, in addition to the abstract page, the abstract text is written into the pdf file's metadata. Write here the text that goes into the metadata. The metadata cannot contain special characters, linebreak or paragraph break characters, so these must not be used here. If your abstract does not contain special characters and it does not require paragraphs, you may take advantage of the abstracttext macro (see the comment below). Otherwise, the metadata abstract text must be identical to the text on the abstract page.

Keywords Machine learning algorithms, Robotic process automation, log parsing, random delay, Microsoft Azure ML Studio

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Tiivistelmä

Tiivistelmässä on lyhyt selvitys kirjoituksen tärkeimmästä sisällöstä: mitä ja miten on tutkittu, sekä mitä tuloksia on saatu.

Avainsanat Koneoppiminen, koneoppimisalgoritmit, ohjelmistorobotiikka, loki, lokin parsiminen, satunnainen viive, satunnaisviive, Microsoft Azure ML Studio

Preface

Pitkäksi venynyt työ
Kiitokset

Otaniemi, February 28, 2022

Matti Haukilintu

Contents

Symbols and abbreviations

Symbols

$\mathbf{B}$	!!!magnetic flux density
$\mathbf{B}$	!!!magnetic flux density

Operators

$\nabla \times \mathbf{A}$	!!! curl of vectorin $\mathbf{A}$
$+$	!!! yep, a plus

Abbreviations

RPA	Robotic Process Automation
ML	Machine Learning
SQL	Structured Query Language
JSON	JavaScript Object Notation

1 Introduction

Artificial intelligence has found its way to more and more fields of business. [!!S] In banking business it is already used in [!!!...]

<What does Samlink do?>

<Samlink, small banking business and machine learning potential>

<RPA in use, but not intelligent processes>

<ML and Azure>

Samlink Oy (Samlink from now on) was founded in 1994 [1] some text [2] <some basic info about Samlink>
<founded year and such>
<what kind of development>
<RPA and such>

1.1 Background and motivation

<current state of samlink AI processes>

<Log format>

<Intelligent automation>

1.2 Research objectives

This research aims to kickstart the machine learning application usage in Samlink operations. Multiple obstacles need to be tackled as most of the phases in this study has not yet been encountered inside the company.

First and foremost, it is crucial to construct some basic form for log data so it is usable by machine learning algorithms. Log data forming is on of the key elements in automatic log parsing applications as it is not for just machines but also for people to read.

As today more and more concern is set on anonymization [!!!...] <Anonymization scope>

<Azure ML studio setup and prerequisites>

<Log data and timestamp combining>

<Connection for data, ML estimates>

1.3 Scope

<Data anonymization>

<Azure setup>

<Data requirements>

<ML methods>

1.4 Methods

<PowerShell anonymization>
    <Regex filtering and data preformatting>
    <Microsoft Azure ML>

1.5 Structure

<how the thesis is organized>

2 Background

2.1 Cloud services

<Azure ML and other cloud services>

2.2 Data protection

<Anonymization and data sensitivity>

2.3 Machine learning methods

<Machine learning field and studies>
<Log data parsing with ML>
<random delay in timeseries(?)>

3 Research material and methods

Tässä osassa kuvataan käytetty tutkimusaineisto ja tutkimuksen metodologiset valinnat, sekä kerrotaan tutkimuksen toteutustapa ja käytetyt menetelmät.

3.1 Data

The data in the research consists mainly of two parts. The most important part is, obviously, the log data produced by the numerous RPA processes. The second part complementing the study is the support ticket data written by clerks of customer banks.

3.1.1 RPA log data

<what form was the data in?>
<how it was acquired?>

3.1.2 Support ticket data

Samlink

3.2 Azure ML Studio

4 Results

4.1 Anonymization

Anonymization took good proportion of the time in workdays as processes were slow, amount of data was big and multiple re-runs were needed before the results was seemed adequate.

[!!! appendix of the script used]

4.2 Data formatting

At the beginning of the research, the log data from RPA was in SQL database. However, the database used was not »pure» in a way that typical relational databases are, but some columns included JSON-formatted data in them. For ML algorithms to be able to read the given data with ease this sort of »impurities» needed to be cleared from the data.

4.3 Azure and Azure ML Studio

<general about ml inside azure>

Azure resources

<what resources was needed inside Azure?>

<virtual machines etc.>

Azure ML Studio components

<clusters and data>

<Memory problems>

During the initial pipeline runs the execution came to an abrupt stop and Azure notified about memory issues. These problems were linked to the data amount which had to be reduced to 600 megabytes before any pipeline could be finished using the data. This reduction was against the initial goal where preferably all the data could have been used.

Considerable amount of time was used to fix or avoid this issue but nothing clear was found that would explain the error received. While working with with the issue it was also noted that data needed more cleaning in order to ease the preprocessing phase as described with more detail in section <!!!4.2> Thus, the data had to be imported from log archive and anonymized once more.

Two choices was possible to take:

1. Continue working with full data and attempting to fix the memory issue by consulting Azure experts

2. Trim the data to reduce the data size by declaring info-type log messages as unnecessary and working with vastly diminished data until the memory issue would be solved one way or another

To advance the study more efficiently it was decided to trim info-type log messages from data hence reducing the data amount considerably. Meanwhile, <fixing the memory issue>

4.4 Machine learning methods and pipelines

<anomaly detection>
<N-Gram Feature extracting>
??? <Poisson regression (predicts event counts)>
<two-class classification> <support vector machine etc>

<Integrating with timestamps>

```
<todo:

***A***
count sum of incidents in timeframe x
set x to each row in data by timestamp
predict amount of incidents based on data

***B***
Use efecte data as reference values
(regression, predict amount in timeframe -> compare)
(classification, count TRUE in timeframe -> compare amount)

>
```

5 Summary

<Sum up here what we did and why>

5.1 Discussion

<Here some thinking what should have been improved>

References

A Esimerkki liitteestä