Classificator

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Installation

Required files

You need the following files provided by the release `(example values)`

- The JAR file `(app-1.1.0.jar)`
- The knowlegdebase file `(kb-1.0.2.db)`
- The configuration file `(configuration.yml)`

CAUTION The configuration file must be placed in the same location as the jar file

Requirements

This program requires an installed java runtime version 11 or higher

Windows/Unix

Since it is a simple .jar file, which can run on any device featuring Java, you can run it by simply doubleclicking.

Docker

Dockerfile

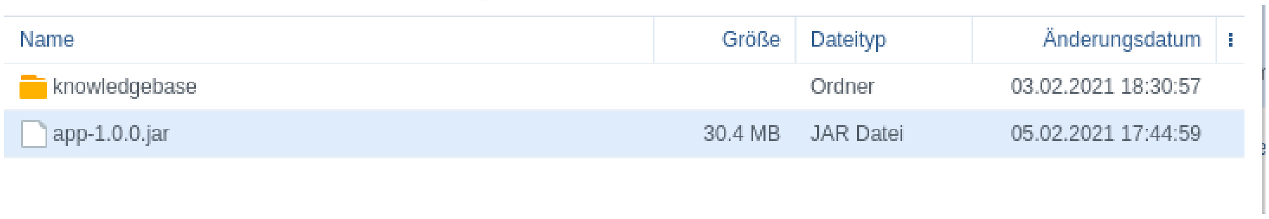
If you can use a dockerfile, you can create one like this: Note to self: Need to test this!

```
FROM openjdk:15-jdk
MAINTAINER Cuupa

WORKDIR /opt/app/classificator

ADD https://github.com/Cuupa/classificator/releases/download/1.1.0/app-
1.1.0_Release.jar /.app.jar
ADD https://github.com/Cuupa/classificator/releases/download/1.1.0/kb-1.0.2.db
/.knowledgebase/kb-1.0.2.db

COPY knowlegebase/*.db ./knowledgebase/
COPY *.jar ./app.jar

EXPOSE 8080

ENTRYPOINT ["java", "-jar", "./app.jar", "--server.port=8080", "--
knowlegde_base=./knowlegebase/kb-1.0.0.db"]
```

Please change the port of the application and change it accordingly.

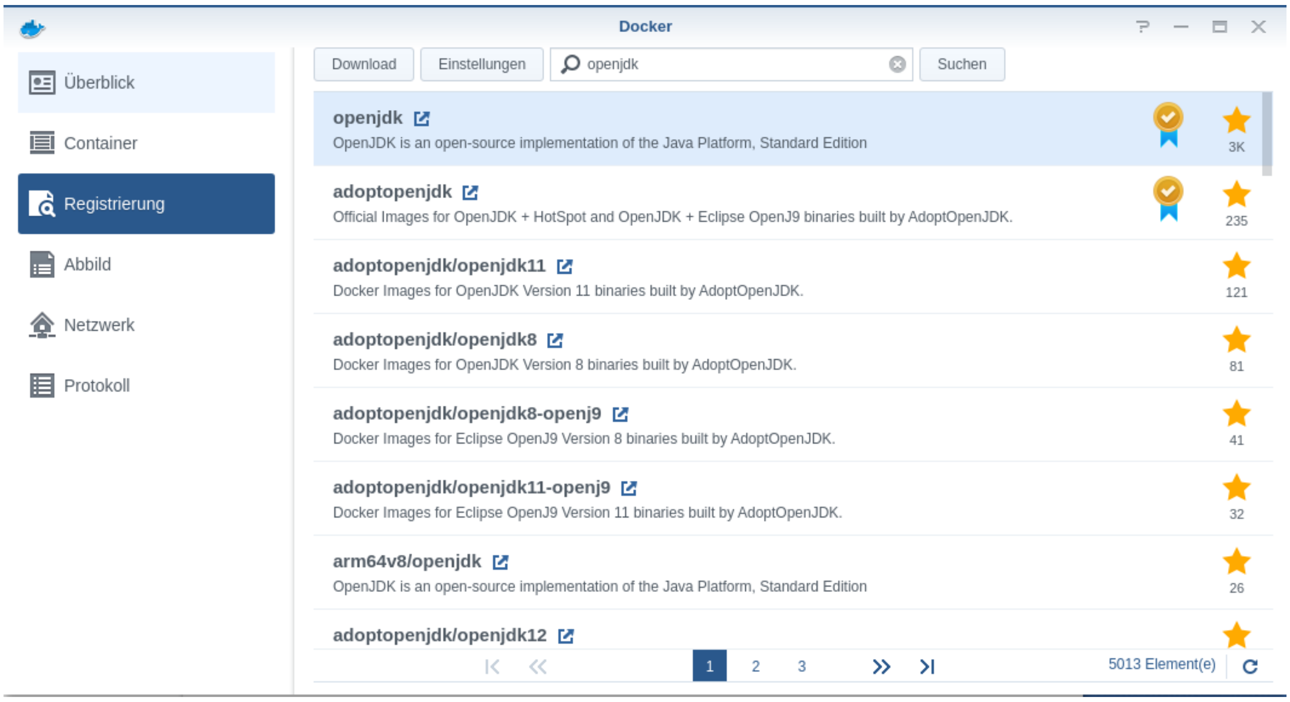
Synology NAS

1. Create yourself a folder, where you upload the files to



Name	Größe	Dateityp	Änderungsdatum
knowledgebase		Ordner	03.02.2021 18:30:57
app-1.0.0.jar	30.4 MB	JAR Datei	05.02.2021 17:44:59

2. Download the openJDK container

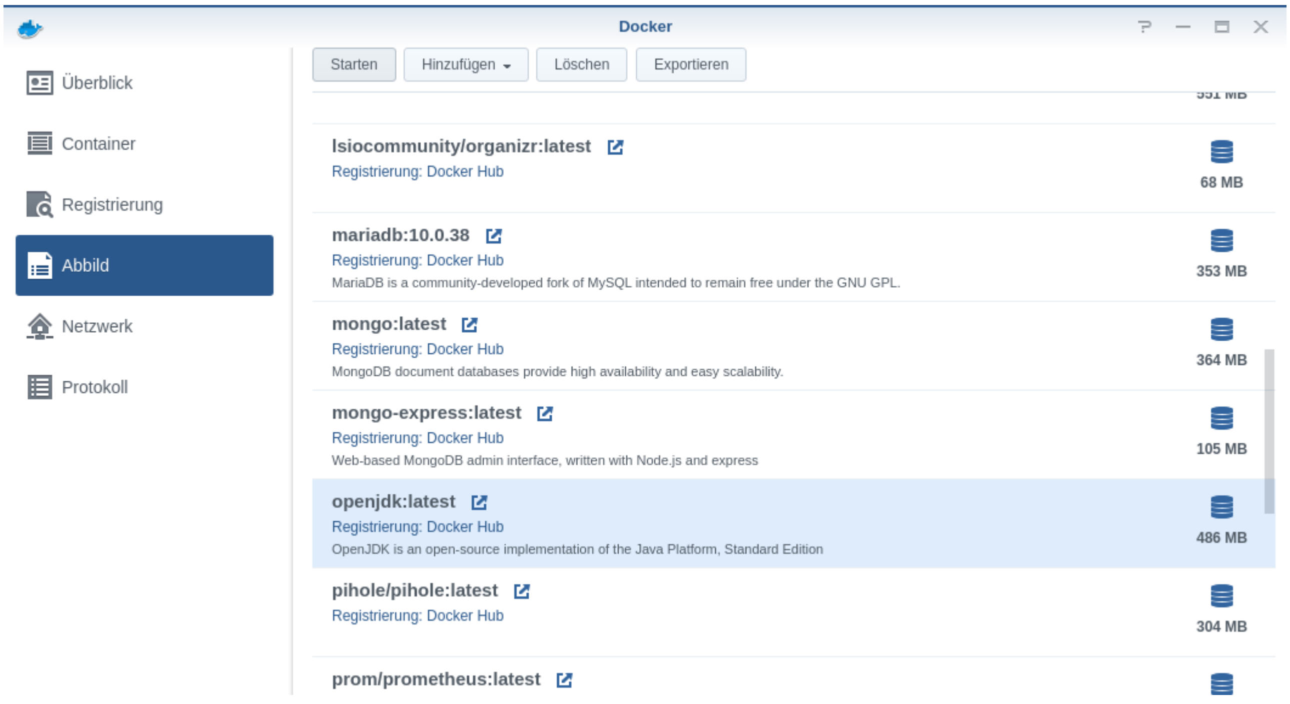

Docker

openjdk

openjdk OpenJDK is an open-source implementation of the Java Platform, Standard Edition	3K
adoptopenjdk Official Images for OpenJDK + HotSpot and OpenJDK + Eclipse OpenJ9 binaries built by AdoptOpenJDK.	235
adoptopenjdk/openjdk11 Docker Images for OpenJDK Version 11 binaries built by AdoptOpenJDK.	121
adoptopenjdk/openjdk8 Docker Images for OpenJDK Version 8 binaries built by AdoptOpenJDK.	81
adoptopenjdk/openjdk8-openj9 Docker Images for Eclipse OpenJ9 Version 8 binaries built by AdoptOpenJDK.	41
adoptopenjdk/openjdk11-openj9 Docker Images for Eclipse OpenJ9 Version 11 binaries built by AdoptOpenJDK.	32
arm64v8/openjdk OpenJDK is an open-source implementation of the Java Platform, Standard Edition	26
adoptopenjdk/openjdk12	

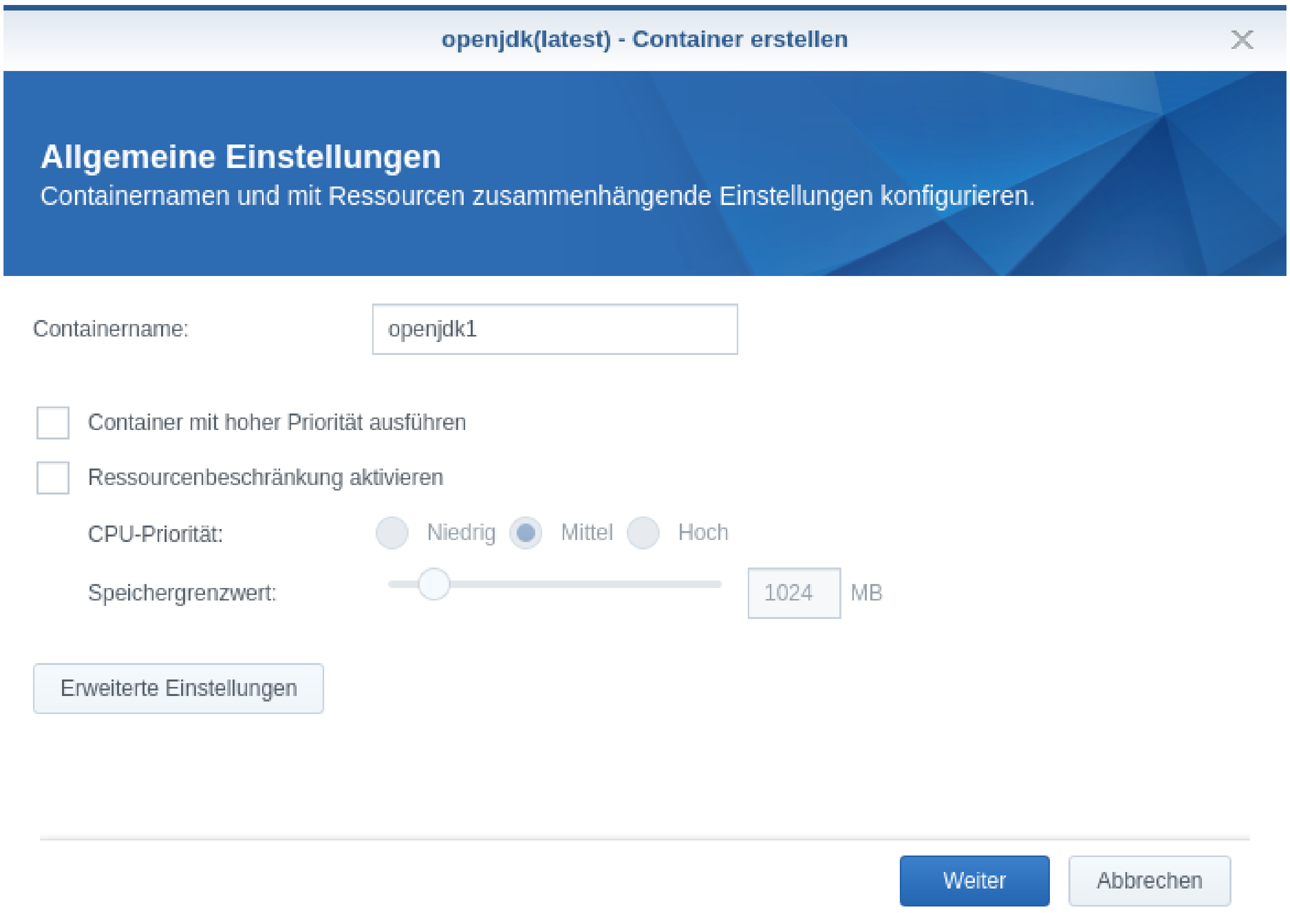
1 2 3 5013 Element(e)

3. Create a new container from this image


Docker

lsiocommunity/organizr:latest Registrierung: Docker Hub	68 MB
mariadb:10.0.38 Registrierung: Docker Hub MariaDB is a community-developed fork of MySQL intended to remain free under the GNU GPL.	353 MB
mongo:latest Registrierung: Docker Hub MongoDB document databases provide high availability and easy scalability.	364 MB
mongo-express:latest Registrierung: Docker Hub Web-based MongoDB admin interface, written with Node.js and express	105 MB
openjdk:latest Registrierung: Docker Hub OpenJDK is an open-source implementation of the Java Platform, Standard Edition	486 MB
pihole/pihole:latest Registrierung: Docker Hub	304 MB
prom/prometheus:latest	

4. Give this container a name to your likings and click on the 'Advanced Settings' button



openjdk(latest) - Container erstellen

Allgemeine Einstellungen

Containernamen und mit Ressourcen zusammenhängende Einstellungen konfigurieren.

Containername: openjdk1

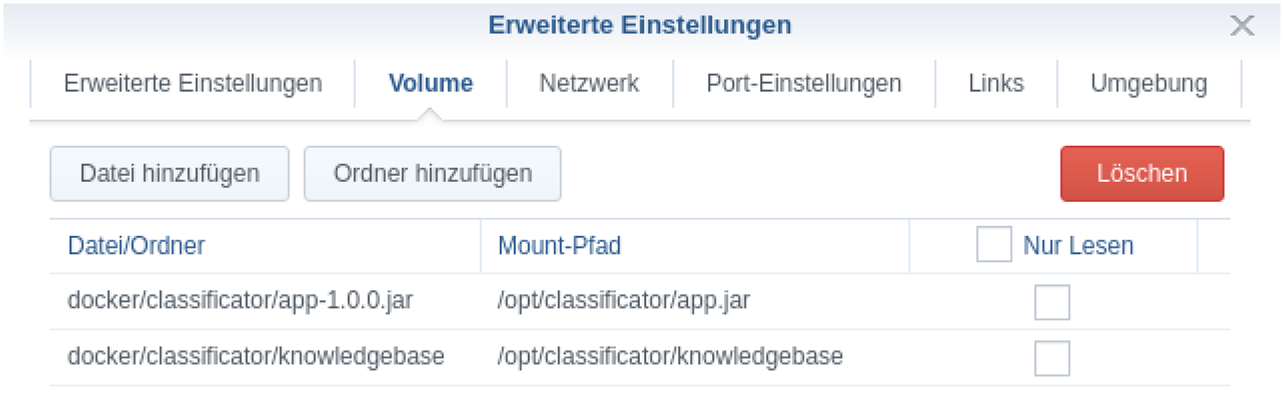
☐ Container mit hoher Priorität ausführen

☐ Ressourcenbeschränkung aktivieren

CPU-Priorität: Niedrig [✓ Mittel] Hoch

Speichergrenzwert: 1024 MB

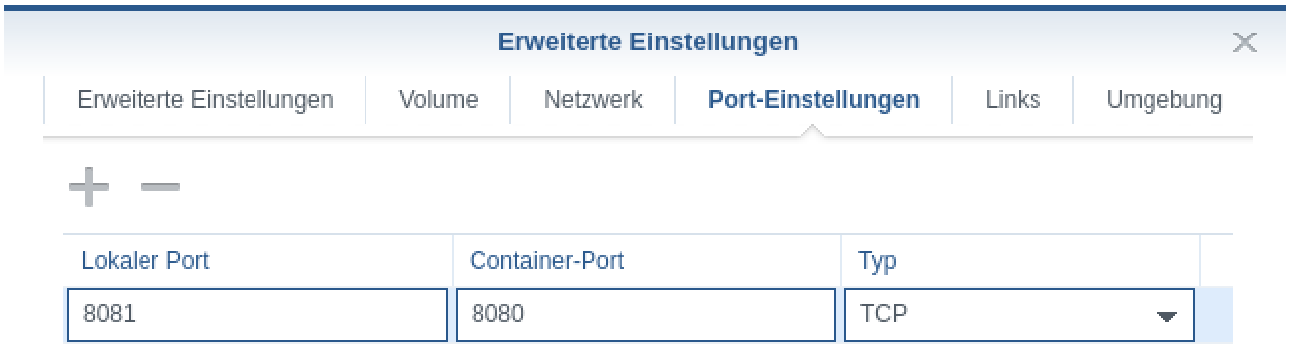
5. Mount your folders and files to the docker container. It is also a good idea to change this to "read only" mode, as this program does not change these files



Erweiterte Einstellungen

Datei/Ordner	Mount-Pfad	Nur Lesen
docker/classificator/app-1.0.0.jar	/opt/classificator/app.jar	☐
docker/classificator/knowledgebase	/opt/classificator/knowledgebase	☐

6. Change the ports to your liking



Erweiterte Einstellungen

Lokaler Port	Container-Port	Typ
8081	8080	TCP

7. Go to the environment tab and paste this as command to run:

```
java -jar /opt/classificator/app.jar '--server.port=8081' '--
knowlegde_base=/opt/classificator/knowledgebase'
```

Finally, run this container. You can access the webui by going to `http://your-nas-ip:your-port` For example `http://192.168.0.3:8081`

Configuration

This is the default configuration of the application
It sets the server port to 8080 and the knowledgebase-directory to `build/knowledgebase`

```
---
classificator:
  knowledge_base: build/knowledgebase

  monitor:
    username: "John"
    password: "Doe"
    enabled: true
    logText: true
    database-name: "monitor.db"
```

Server port

The default port of this application is `8080` So if you want to access the webUI on your local machine navigate to `https://localhost:8080`. If you want to change that port, see Changing via command line arguments

Knowledgebase

This entry means, that there has to be a folder named `build/knowlegebase` beside your jar file. You can specify which knowledgebase to use, by changing it via the command line arguments (How that works will be covered by me a few lines down below).

TIP If this entry only contains a folder name without the specific knowlegedbase, it will load the file with the highest version tag in that folder
For example if you have `kb-1.0.0.db` and `kb-1.0.1.db` it'll load the `kb-1.0.1.db`

```
knowlegde_base: build/knowledgebase
```

Monitor

The monitor is enabled by default and uses the database `monitor.db`

```
monitor:
   username: "John"
   password: "Doe"
   enabled: true
   logText: true
   database-name: "monitor.db"
```

Username and password

These entries set the username and password for accessing the statistics under `/monitor`

Database name

The database name is defined via `database-name`. You can change it to your likings. It uses relative paths by default. If you want to use absolute paths, change it to

```
database-name: "C:\Users\John Doe\monitor.db"
```

Enabled and logText

If `enabled` is set to `true`, all events will be logged. To turn it off, set it to `false`. If `logText` is enabled, the actual analyzed texts will be logged into the database. You might want to turn it off for privacy reasons, but it really helps finding errors in the classification process.

Changing

CAUTION If you use the command line arguments, the corresponding entry in the configuration.yml will be overwritten

Via config

If you want to change the configuration, just edit it with any text editor and change it to your likings

```
knowlegde_base: knowledgebase/kb-1.0.0.db
```

or

```
monitor:
  logText: false
```

Save the file and restart your application.

NOTE Changing the config file and restarting the application is the recommended way of changing program parameters.

Via command line arguments

You can also use the command line arguments

CAUTION The server port can only be changed by using the command line arguments

```
java -jar app.jar --server_port=8080 --knowledge_base=knowlegebase/kb-1.0.0.db
--classificator.monitor.logText=false
```

NOTE The first part simply runs the jar by the name "app.jar"

```
java -jar app.jar
```

NOTE This part sets the port to 8080 and overwrites the value of the default configuration

```
--server_port=8080
```

NOTE This part sets the location of the knowledgebase. You can use relative paths like

```
--knowledge_base=knowlegebase/kb-1.0.0.db
```

NOTE or absolute paths like

```
--knowledge_base="C:\Users\John Doe\knowlegebase\kb-1.0.0.db"
```

CAUTION Notice that, you need to quote the value as soon as you have spaces in a parameter

Components

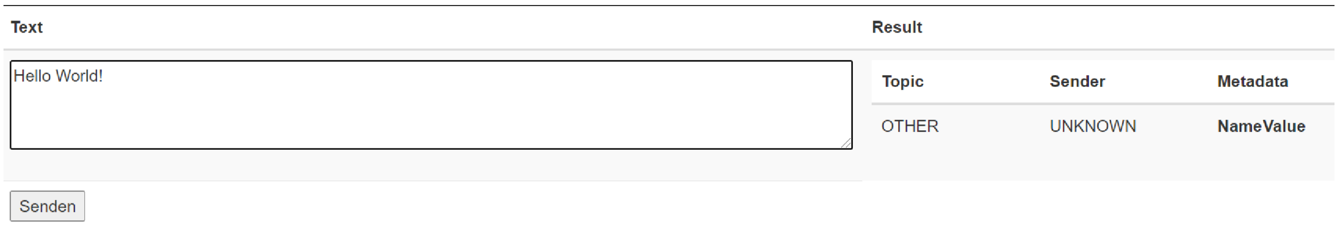
Engine

The engine is the core component of this application.It classifies the text and extracts the metadata

Using the GUI

You can use the gui exposed at `http://address-of-your-server:port`

You can type in or paste the text to the left-hand textarea, which the engine shall analyze and hit the "Submit"-Button.The result will be presented in the right-hand area



Text	Result		
Hello World!	Topic	Sender	Metadata
	OTHER	UNKNOWN	NameValue

Using the REST-API

The engine exposes several methods for analyzing the input text.The most simple one receives the text as a string and returns a `List<SemantikResult>`

The endpoint-path is:

```
"/api/rest/1.0/classifyText"
```

If you want to analyze anything except plain text the method accepts any byte array and uses a combination of `PDFBox` and `Apache Tika` to extract its contents for you.

```
"/api/rest/1.0/classify"
```

TIP There's also a method for pinging the application. This method simply returns a HTTP/200

```
"/api/rest/1.0/ping"
```

How it works

If no text is provided, the engine simply returns an empty result. Otherwise the text is processed in several steps.

The Knowledgebase

The knowledgebase is just a simple 7z archive, containing descriptions of the topics, the senders, the metadata and regexes.

The topics, senders and metadata may contain any number of following tokens:

- All

- Not
- OneOf
- WildcardBefore

Example of a topic:

```
BILL = {
    oneOf("rechnung","jahresrechnung","Zahlung der","zahlen Sie den
Betrag","Rechnungs-Nr","rechnungsbetrag"),
    oneOf("eur, "euro", "€"),
    not("beitragsrechnung"),
    not("dauerauftrag", "quittungsbeleg"),
    not("versicherungsschein", "versicherungs-nr"),
    not("gehaltsabrechnungen"),
    not("rechnung trägt"),
    not("keine Zahlung erhalten"),
    not("jahresdepotauszug")
}
```

Example of a sender:

```
Rundfunk Beitragsservice = {
    oneOf("Deutschlandradio"),
    oneOf("BEITRAGSSERVICE"),
    oneOf("ARD", "ZDF");
}
```

Example of a sender:

```
$IBAN = {
    oneOf("IBAN: [IBAN]", "IBAN [IBAN]")
}
```

NOTE The value inside the [] brackets is the file name of the regex definition, which shall be injected

Example of a regex:

```
[a-z]{2}[0-9]{2}[\s]?[0-9]{4}[\s]?[0-9]{4}[\s]?[0-9]{4}[\s]?[0-9]{4}[\s]?[0-9]{2}
```

CAUTION The regular expressions are `case insensitive`

Text normalization

This step is mandatory for all but metadata. The text is converted to all-lowercase, whitespaces are replaced with a `blank` and characters like "ä" are replaced with "ae"

```
private fun normalizeText(text: String): String {
        return text.toLowerCase()
            .replace(StringConstants.tabstop, StringConstants.blank)
            .replace("\n\r", StringConstants.blank)
            .replace("\r\n", StringConstants.blank)
            .replace(StringConstants.carriageReturn, StringConstants.blank)
            .replace(StringConstants.newLine, StringConstants.blank)
            //      text = text.replace("-", StringConstants.BLANK);
            .replace(",", StringConstants.blank)
            .replace(": ", StringConstants.blank)
            .replace("€", " €")
            .replace("Ãœ", "ae")
            .replace("ä", "ae")
            .replace("ã¼", "ue")
            .replace("ü", "ue")
            .replace("/", StringConstants.blank)
            .replace("_", StringConstants.blank)
            .replace(RegexConstants.twoBlanksRegex, StringConstants.blank)
            .trim()
    }
```

CAUTION Text which is parsed to extract the metadata will not be normalized

Finding Topics

This step is the most simple one.
First of all the text is normalized like described above. Then, it’ll be passed through each token for that topic like `NOT` and `OneOf`. The token tries to find its value like "awesome" in the text using the `Levenshtein-distance`. The Levenshtein-distance computes the difference between the text and the tokenvalue itself.

NOTE "awesome" and "awesome" results in a distance of 0, where "awesome" and "awsome" has a distance of 1, whereas the number represents the number of changes for one string to become equal to the other string

If the distance is less than 2 (so a distance of 0 or 1) it matches. This is done to counter OCR errors (like mistaking a lowercase-"L" for an uppercase-"i")

Finding Senders

Finding senders is a 2 stage process. In the first stage, the sender defintions inside the knowledgebase are matched against the text which should be analyzed. If a sender is found: great!

If no sender is found, the text ist processed by the second stage. The engine tries to match the defintion

```
$sender = {
    oneOf("[SENDER]")
}
```

with the regex

```
((?!(Ihre|Handelsregister|Die)))[a-zA-Z0-9]{1}[0-9& a-zA-Zäöü\-]+
(AG|a\.G\.|GmbH|SE|OHG)
```

CAUTION This regex is only valid for german companies

Being a relatively coarse regex, this will match more words than the actual company name may be. To determine the actual sender, the matched regex result is weighted by `number of occurences in the text * number of words matched`

Finally the sender is determined by removing all matches with 5 or more `blanks` and returning the result with the most occurences in the text as the final sender.

Finding Metadata

Extracting the metadata is the most costly operation of all recognition, because of the ability to use regex and the need of recompiling the metadata defintions for every call.

Every result then is normalized like inserting spaces in an IBAN.

Monitor

The monitor is a statistical tool for getting informations on topic distributions, execution time and a history of processed texts with the recognized results etc.

Currently, theres pie charts for topic and sender distribution, a line chart for execution time and a table with the history.

The table consists of the columns:

- Knowledgebase version
- Received
- Processing Time
- Topics
- Senders
- Metadata
- Analyzed Text
- Download

NOTE The analyzed text is only persisted if you enabled it via the config file

NOTE The download column provides a link for saving this specific entry as a `CSV` file in case of reproducing classification errors etc.