

Using Natural Language Processing and Machine Learning to Assist First-Level Customer Support for Contract Management

Master thesis - Kickoff presentation

Michael Legenc

Advisor: Daniel Braun

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Software Engineering betrieblicher Informationssysteme (sebis)
Fakultät für Informatik
Technische Universität München

www.matthes.in.tum.de

Michael Legenc

- **Master Informatics student:**
4. Semester
- **Since 2009 self-employed (Web-)Developer:**
<http://michael.legenc.de/>
- **Interested in:**
 - Web development
 - Web Scraping
 - Data processing

Motivation

- **Email customer support crucial to many businesses.**
 - A lot of manpower needed to process all incoming emails.
- **Fast processing**
 - is time and thus cost saving.
 - increases customer satisfaction.
- **Recurring topics:**
 - Automation might be beneficial.
 - Exhausting, repetitive work decreases employee satisfaction.



„I'd like to revoke my contract with the number 34239421“



Classification using supervised Machine Learning

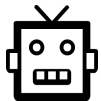


Information extraction by NLP

**Main part of
the research.**

{json}

```
{
  "classification": "REVOCATION",
  "extractedInformation": {
    "contractNumber": 34239421
  }
}
```



Take automatic action

**Just one example to
proof the concept.**

Cancellation of Contract

Contract team

High priority

Revocations



My Customer <customer@mycompany.de>

to 

14:00 PM (1 hour ago)



I'd like to revoke my last contract with the number 34239421'

Reply:

Your request is being processed. We will get back to you shortly.

Sorry, your contract cannot be cancelled. Please visit this link for more information

Your contract has been successfully cancelled.

Contract Management

Customer: My Customer

Email: customer@mycompany.de

Contracts: Red 3GB with iPhone 7

Cancel contract

- Auto-responses, Auto-triggering of actions
- Analytics



German comparison portal

Energy department (Gas, Electricity) provides emails:

≈ 18.000.000 emails since 2013

≈ 1000 incoming emails/day at peak times

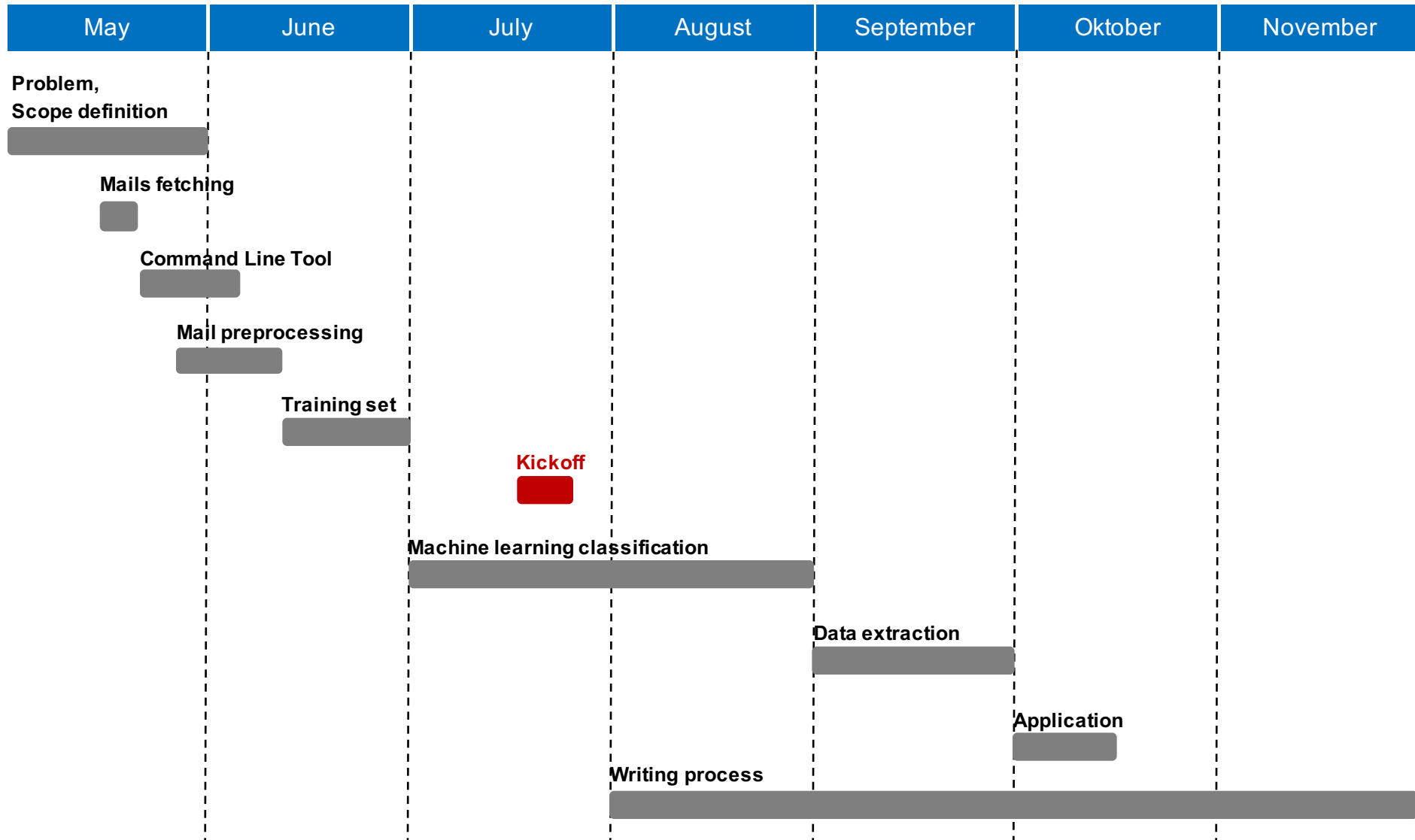
Research questions

- How can **NLP and ML** assist first-level customer support?
- What **email preprocessing** is beneficial for the ML?
 - How to transform the email bodies to the essence?
 - Are there better predictions by this?
- How to design and support the process of **creating a training set**?
 - How to find interesting classes in a mass of emails? How many?
 - How to handle upcoming changes?
 - How to support the manual labeling process?

Research questions

- Which **machine learning algorithm** is appropriate to classify emails reliably?
 - How to handle mails with several topics?
 - How certain is a single prediction?
- How to **extract context information** from free text?
- Which **applications** are empowered by all of this?
- How does the results **evaluate** in the context of check24's energy department?

Timeline



Thesis registration: 15.07.2017

Latest submission date: 15.01.2018

```
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Possible labels:
0: OTHER   1: REVOCATION   2: CHANGE_INFO   3: STATUS_QUESTION   4: BONUS_QUESTION
5: GAS_METER_NUMBER   6: GAS_METER_READING   7: CHOICE_BETWEEN_MULTIPLE_ORDERS   8: ABSENT   9: CHANGE_DATE
10: THANK_YOU   11: REQUEST_TO_GET_CALLED   12: CANCELLATION   13: I_HAVE_CANCELED   14: PLEASE_CANCEL_FOR_ME
15: I_WANT_TO_CANCEL   16: DO_I_HAVE_TO_CANCEL   17: COULD_NOT_CANCEL   23: ORDER_NOT_IN_ACCOUNT   25: UNSUBSCRIBE_AD
27: SPAM   31: COUPON   38: LATER   39: PAYBACK   43: GAS_ELECTRICITY_METER_NR
45: INSTANT_BONUS   47: NEW_CUSTOMER_BONUS   48: CHANGE_BONUS   49: POSITIVE_BALANCE   50: LOYALTY_BONUS
51: WILL_YOU_CANCEL_FOR_ME

Concat multiple classes with a ",".

Commands:
new: Create a new label   skip: Go to next mail   exit: End training

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#### Mail ID: 25055724
#### Mail FROM: [REDACTED]@googlemail.com>
#### Mail BODY:
Ich hab den Wechsel heute widerrufen. MFG schwarz

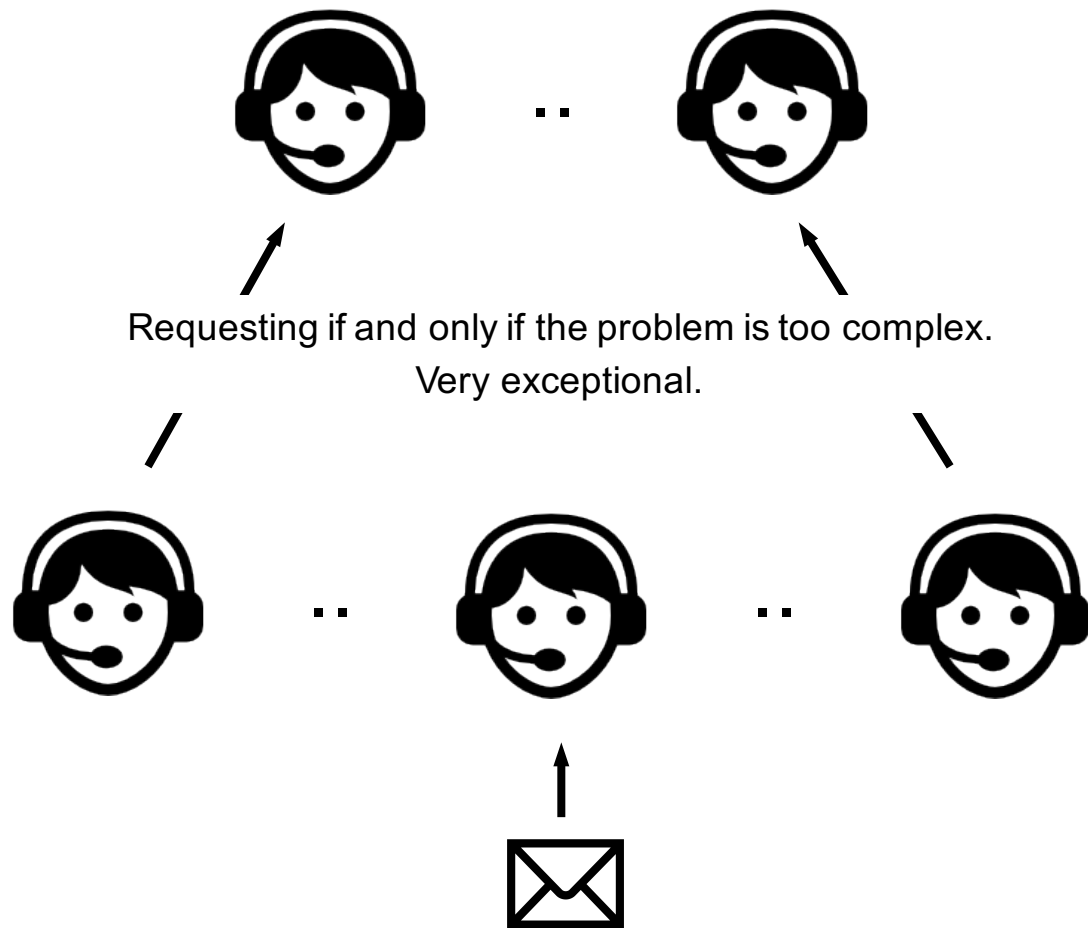
Prediction: 1 REVOCATION
Enter a command or class [1]:
```

- **Classification and context-related information extraction with ML and NLP empowers automation.**
- **Email customer support benefits from automation:**
 - Time, thus cost saving.
 - Increased employee and customer satisfaction.
- **Thesis research is about finding reliable approaches and processes regarding ML and NLP.**

Thank you

Current customer support team organization

at check24's gas and electricity department



Second-level support
Long-time employees.

First-level support
Trying to solve all kinds of problems.

Incoming email
gas@check24.de or
strom@check24.de

Current email preprocessing



Storage

MySQL Server

Long-time storing of all incoming and outgoing emails with the determined folder and customer mappings.



Customer detection

PHP-Server

Mapping mails to customers and simple folders like gas/electricity (unseen) inbox/spam.



Spam detection

Microsoft exchange server

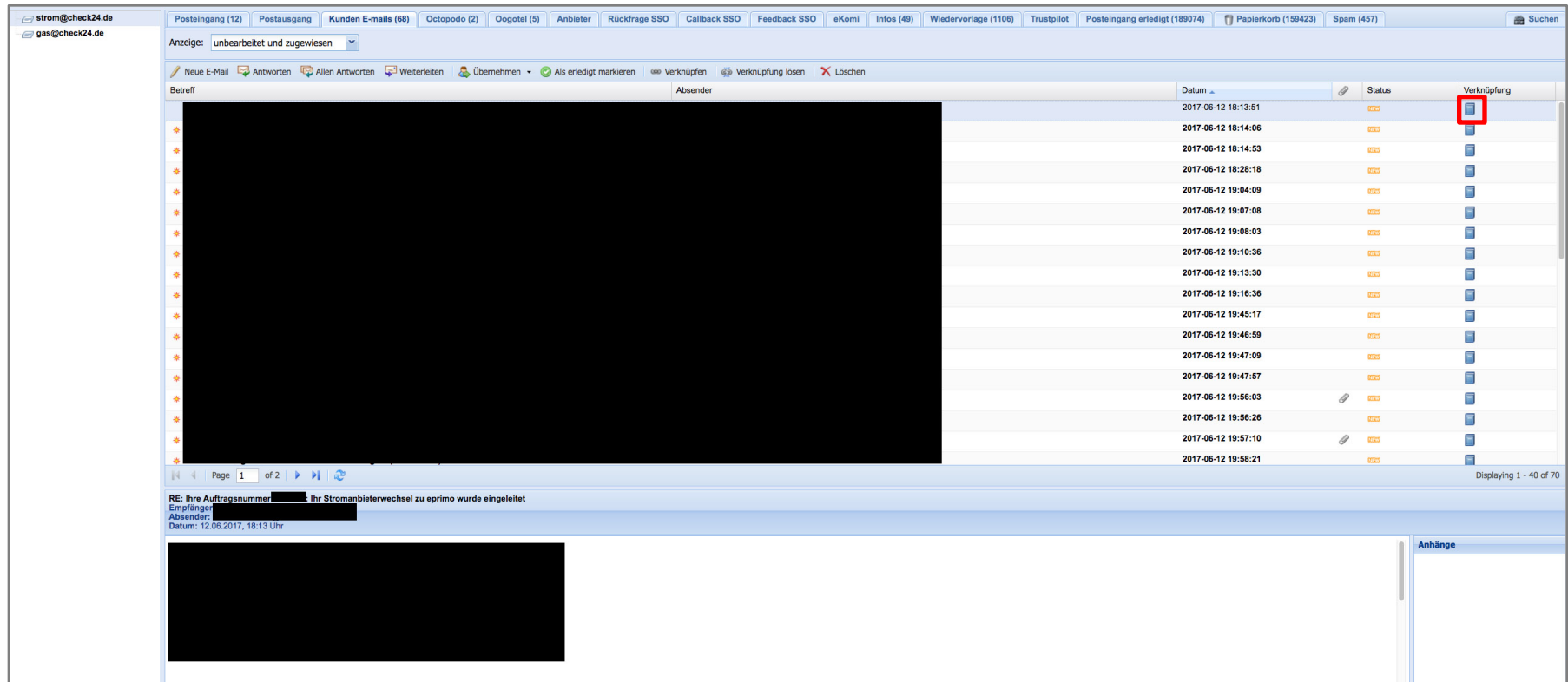


Incoming email

gas@check24.de or strom@check24.de

Software used by the customer support

Webmail: Superficial mail inspection.



Button (e.g. in the red box) leads to a more sophisticated solution.

Software used by the customer support

Proprietary software: View mail with further information and processing features.

Allgemein
 Bestellbestätigung
 E-Mail Standard
 gewünschter Lieferbeginn

Rückfrage
 Rückfrage SMS
Daten fehlen
 Kundennummer fehlt
 Zählnummer fehlt
 Bankdaten fehlen
 Vorversorger fehlt
Daten ungültig
 Neueinzug ungültig
 Kündigung liegt i. d. Vergangenheit
Unklare Daten
 2 Zählnummern
 Doppelantrag
 Zählpunktnummer statt Zählnummer angegeben
 Kundennr. und ZN identisch
Problemfälle
 Storno intern
 Vertragsangebot abgelaufen

nach Übermittlung
 Widerruf
 Statusabfrage Kunde
 Sofortbonus Anbieter
 Check24 Sofortbonus

Rückmeldung Versorger
 ZN bereits in Belleferung
 ZN bereits in Belleferung (Neueinzug)
 1 PLZ, 2 Netzbetreiber
 Wechseltermin noch nicht möglich
 Anbieterwechsel fehlergeschlagen
 Verzögerung bei Übermittlung
 Auftrag erfolgreich bearbeitet

Bewertungs-E-Mail

Auftrags-Historie (1)

E-Mails (0)

Anhänge (0)

E-Mail - / SMS-Autorisierungsverlauf, E-Mail / SMS für Daten unvollständig

Alte Anfrage stornieren und neue Anfrage senden per:
 ☐ SMS
 ☐ E-Mail

Nachricht konnte nicht zugestellt werden.

Seite: 1
 Einträge: 2

ID	Typ	Sender	Empfänger	Nachricht	Datum, Uhrzeit
1720326	out	energie-9343257@vergleich.check24.de		Sehr geehrter Herr Mustermann, vielen Dank für Ihr Vertrauen. Die Daten für Ihren Auftrag zum Stromtarifwechsel wurden telefonisch erfasst, Ihren Auftrag finden Sie als PDF anbei. Um den Auftrag zu bestätigen, antworten Sie bitte auf diese E-Mail mit JA oder klicken Sie hier. Sollten Ihnen bei der Überprüfung des Auftrages fehlerhafte Angaben aufgefallen sein oder haben Sie noch Fragen zu Ihrem Auftrag, so wenden Sie sich hierfür bitte an energie@check24.de.	12.06.2017 13:15:27
				Vielen Dank für Ihren Auftrag (Vattenfall Sales, Easy12 Strom, Auftragsnr.: 9343257). Um	

But how?

