2 Teoretischen Teil

This chapter presents topics and related work from various fields of study relevant for the presented problem and for the solution descriped in chapter 3

**Human Memory and Forgetting**

Human memory is a complex cognitive system that involves multiple processes, including encoding, storing, and retrieving information. However, our memory is not always perfect, and we often forget important details, tasks, or items on our to-do lists.

One common psychological phenomenon related to memory and forgetting is the "shopping list effect." Despite creating a shopping list to remember items, people often forget to buy certain items when they are at the store. This phenomenon can be attributed to various cognitive factors, such as attentional lapses, interference, or context-dependent memory.

While human memory has its limitations, as evidenced by the “shopping list effect” and other forgetting phenomena, humans habe devised ways to compensate for these limitations using technology and leaving AI, algorithms and applications do the work for them

**2.1 The importance of a mobile application in everyday life**

Mobile applications have become a cornerstone of modern technology, evolving and advancing alongside the rise of smartphones. These apps serve as both functional tools and creative enhancements, transforming our smartphones into versatile devices tailored to our daily needs. With a focus on user-friendly design and innovative features, developers continuously innovate to offer mobile apps that simplify tasks and enrich our lives, making technology more accessible and enjoyable.

Initially, mobile apps were primarily designed for information retrieval and productivity. However, as technology evolved and various tools became more accessible, people began to shift their focus towards broader goals and purposes. This shift, coupled with the enhanced capabilities of smartphones, has led to the development of more sophisticated and user-centric app designs. Today's mobile apps encompass a wide range of categories, catering to diverse needs and preferences, and reflecting the multifaceted roles that smartphones play in our lives.

Applications have made life easier and are always on hand to save time, effort and dependencies. You want to make a few transactions; financial apps save you a visit to the bank. If you need groceries, you can use an app to shop from home and have everything delivered to your door.

Here are some areas that have contributed to making mobile apps indispensable in our daily lives.

￼

While mobile apps have undoubtedly revolutionized the way we access information, accomplish tasks and interact with the world around us, their true significance lies in their ability to supplement and compensate for human limitations, such as those seen in memory and cognitive processes. By leveraging AI, algorithms and innovative features, mobile apps not only streamline daily tasks and increase productivity, but also serve as digital assistants that remember, organize and prioritize information.

In the area of mobile applications, integrating chatbots, Artificial Intelligence and web scraping has paved the way for creating more interactive, intelligent, and data-driven user experiences.

But before delving into the intricate integration of chatbots, Artificial Intelligence, machine learning, and Natural Language Processing in mobile applications, it is crucial to establish a clear understanding of these foundational elements. Additionally, recognizing the significance of well-organized data underpinning these technologies is crucial. This section aims to elucidate these concepts to provide a comprehensive groundwork for the subsequent discussion.

**2.1 Introduction to Artificial Inteligence**

Since Alan Turing's groundbreaking exploration of the possibility of programming an electronic computer to exhibit intelligent behavior, artificial intelligence (AI) has seen rapid growth in research and development over recent decades, everybody hearing about it or using it at least once in their lifetime. However, fewer people have pondered the question of what exactly AI is and how it functions. Simply put, Artificial Intelligence refers to the simulation of human intelligence in machines. These machines are programmed to think and act in ways that mimic human behavior or exhibit traits commonly associated with human cognition, such as learning, language understanding, problem-solving, decision-making and perception.

AI encompasses a wide array of technologies and methodologies. This includes natural language processing, enabling machines to understand and respond to human language; machine learning, where machines are trained to learn from data; deep learning, a subset of machine learning utilizing multi-layered neural networks; and robotics, which involves machines capable of sensing, thinking, and acting autonomously.

In this research our focus is on machine learning and natural language processing, which are also, the main components of a chatbot.

￼

**2.2 Natural Language Processing**

Originating in the 1950s, Natural Language Processing (NLP) emerged at the intersection of artificial intelligence and linguistics. It is a field of research and application that investigates how computers can be used to understand and process text or speech in natural language to do useful things. NLP researchers seek to gain insights into how humans understand and use language so that appropriate tools and techniques can be developed to enable computer systems to understand and process natural language to accomplish desired tasks.

Early NLP approaches faced challenges with word-for-word translations due to homographs (words with multiple meanings) and metaphorical language. For instance, the Biblical phrase, 'the spirit is willing, but the flesh is weak,' was humorously translated to 'the vodka is agreeable, but the meat is spoiled.'

the integration of machine learning techniques has become pivotal to the advancements and capabilities of Natural Language Processing (NLP). Traditional rule-based approaches in NLP, which depended on manually crafted rules and linguistic patterns, have largely given way to or been augmented by machine learning algorithms and deep learning models. With the help of machine learning NLP systems can now learn from data, adapt to new patterns, and improve their performance over time. This evolution has rendered NLP systems more robust, accurate, and versatile.

The integration of machine learning in NLP offers several benefits, including improved accuracy, scalability, and adaptability to new tasks and languages. Machine learning models can learn complex patterns and nuances in language, making them more effective in understanding context, handling ambiguity, and generating human-like responses.

**2.3 Machine learning**

Machine learning is a subfield of artificial intelligence (AI) that focuses on the development of algorithms and statistical models that enable computers to learn from and make predictions or decisions based on data. Instead of being explicitly programmed to perform a specific task, machine learning algorithms use statistical techniques to learn from data and improve their performance over time without human intervention.

The core idea behind machine learning is to enable computers to learn from experience (i.e., data) and adapt to new data or situations, much like how humans learn from experience. Machine learning algorithms are trained using large datasets, where they learn patterns, correlations, and relationships within the data to make predictions or decisions.

Machine learning can be categorized into several types based on the learning strategy and the nature of the data:

Supervised Learning: In supervised learning, the algorithm is trained on labeled data, where each input is paired with the correct output. The goal is to learn a mapping from inputs to outputs, enabling the algorithm to make predictions or classifications on new, unseen data.

Unsupervised Learning: In unsupervised learning, the algorithm is trained on unlabeled data, and its goal is to find patterns or structures within the data, such as clusters or associations. Unsupervised learning is often used for tasks like clustering, dimensionality reduction, and anomaly detection.

Reinforcement Learning: In reinforcement learning, the algorithm learns by interacting with an environment and receiving feedback in the form of rewards or penalties. The goal is to learn a policy or strategy that maximizes the cumulative reward over time. Reinforcement learning is commonly used in applications like game playing, robotics, and autonomous systems.

Deep Learning: Deep learning is a subset of machine learning that uses neural networks with many layers (hence "deep") to learn from data. Deep learning has achieved state-of-the-art performance in various tasks such as image recognition, natural language processing, and speech recognition.

**2.4 How does NLP with machine learning work**

**Supervised Learning in NLP**

Supervised learning is one of the most widely used machine learning approaches in NLP. In supervised learning, models are trained on labeled datasets, where each input is paired with the correct output. For example, in sentiment analysis, a supervised learning model can be trained to classify text as positive, negative, or neutral based on labeled examples. Algorithms such as Support Vector Machines (SVM), Random Forests, and Neural Networks are commonly used in supervised learning for NLP tasks like text classification, named entity recognition, and part-of-speech tagging.

**Unsupervised and Semi-supervised Learning**

Unsupervised learning techniques, such as clustering and topic modeling, are also employed in NLP to discover patterns and structures in unlabeled data. Topic modeling algorithms like Latent Dirichlet Allocation (LDA) can identify topics within a large corpus of text without the need for labeled data. Additionally, semi-supervised learning combines both labeled and unlabeled data to improve model performance, which is particularly useful when labeled data is scarce or expensive to obtain.

**Deep Learning and Neural Networks**

Deep learning, especially neural networks, has revolutionized NLP by achieving state-of-the-art performance across various tasks. Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) networks, and Transformer architectures like BERT and GPT have become foundational in modern NLP. These deep learning models can process sequential data, capture long-range dependencies in text, and learn hierarchical representations of language, enabling them to excel in tasks such as machine translation, text summarization, and language understanding.

**2.4 Chatbots**

Chatbots, or conversational agents, are AI-powered applications designed to simulate human conversation. They interact with users through text or voice, providing information, answering questions, and assisting with tasks. Chatbots can be categorized based on their complexity and capabilities, ranging from simple rule-based systems to advanced AI-powered virtual assistants.

Chatbots are finding applications across various industries, including customer service, healthcare, e-commerce, and banking. They are used to automate routine tasks, provide personalized recommendations, assist with inquiries, and enhance user experiences.

NLP plays a crucial role in enabling chatbots to understand and generate natural language. By employing NLP techniques such as text classification, named entity recognition, and sentiment analysis, chatbots can interpret user input, maintain context, and generate appropriate and meaningful responses. This enables more interactive and personalized user experiences, making chatbots valuable tools in customer service, healthcare, e-commerce, and more.

With the availability of improved data sets and more advanced machine learning algorithms, chatbots have increasingly utilized machine learning to enhance their natural language understanding, response generation, and personalization capabilities. With machine learning algorithms, chatbots can learn from previous interactions, adapt responses to user preferences, and offer a more natural and efficient conversational experience.

**2.5 Chatbots in Mobile Applications**

Customer Support: Chatbots can provide 24/7 customer support, answering queries, resolving issues, and guiding users through app functionalities. This enhances user satisfaction by offering immediate assistance.

Personalized Interactions: AI-powered chatbots can engage users in personalized conversations based on their preferences, behavior, and past interactions. This creates a more tailored and engaging user experience.

Automated Transactions: Chatbots can facilitate automated transactions, such as booking appointments, ordering products, or making payments, simplifying processes and improving efficiency.

Data Collection and Analysis: Chatbots can gather user feedback, preferences, and behavior data during interactions. This data can be analyzed to gain insights into user needs, trends, and preferences.

**2.3 Data sets for Machine Learning**

We are in the age of data abundance. From IoT and cybersecurity to social media and health, everything is captured digitally. This data, whether structured, semi-structured or unstructured, is growing exponentially and contains valuable insights. Gaining these insights is crucial for the development of intelligent applications in various fields. Therefore, there is an urgent need for data management tools and techniques that are able to extract insights or useful knowledge in a timely and intelligent manner from the data on which real-world applications are based. For example, cybersecurity data can be used to build automated security systems, while mobile data can improve personalized mobile applications.

Machine learning (ML), a branch of artificial intelligence (AI), has rapidly emerged as a powerful tool for analyzing this data. ML enables systems to learn and improve from experience without explicit programming, making it a cornerstone of the fourth industrial revolution (Industry 4.0). As industry increasingly automates and adopts intelligent technologies such as ML, the ability to analyze data intelligently is becoming more and more important. Essentially, ML algorithms are the key to harnessing the potential of data and developing intelligent applications for the real world.

In general, the effectiveness and the efficiency of a machine learning solution depend on the nature and characteristics of data and the performance of the learning algorithms. Many people focus on the learning algorithms part but the nature and the characteristics of data is as important. Addressing challenges such as overfitting, data quality, and interpretability can impact the performance and reliability of ML models. This arises the question: can a web scraper be a sustainable part in building a dataset?

**2.4 Web scraping**

Imagine a world where data is the new gold, and web scraping is the mining operation.

In the digital age, web scraping has become a critical tool for businesses, researchers, and developers to gather and analyze information from the internet.

At its core web scraping is the process of extracting and collecting data from websites automatically. It involves fetching the HTML content of a web page and then parsing it to extract the desired information. Web scraping is widely used in various domains for data collection, analysis, and automation. Here's a detailed overview of web scraping:

The basic design of a web scraper is shown in Figure 1 as follows

￼

Figure 1

How Web Scraping Works

**Fetching Web Pages**: The first step in web scraping is to fetch the HTML content of the web page you want to scrape. This can be done using HTTP requests, typically using libraries like requests in Python.

**Parsing HTML**: Once the web page is fetched, the next step is to parse the HTML content to extract the relevant data. This is often done using parsing libraries like BeautifulSoup or lxml in Python.

**Extracting Data**: After parsing the HTML, you can extract the desired data such as text, links, images, or any other information based on the specific requirements.

**Storing Data**: Finally, the extracted data can be stored in various formats like CSV, Excel, or databases for further analysis or use.

**2.5 AI Datasets from web scraping**

Web scraping has emerged as a powerful tool for data collection, enabling researchers and data scientists to gather large volumes of data from websites efficiently. With the proliferation of machine learning applications across various domains, the demand for high-quality, domain-specific data sets has increased. Web scraping offers a cost-effective and scalable approach to generating machine learning data sets tailored to specific research questions or applications. give me more

**Advantages of using datasets made from webscraping**

**Customization:** Web scraping allows you to collect data tailored to your specific research questions or machine learning tasks, providing domain-specific or niche data that may not be available in standard datasets.

**Timeliness**: Web scraping enables you to collect real-time or up-to-date data from websites, which can be crucial for certain applications like stock market prediction, news sentiment analysis, or event detection.

**Large-Scale Data Collection**: Web scraping can be scaled to collect large volumes of data from multiple sources simultaneously, providing a more extensive dataset for training machine learning models.

**Data Diversity**: Web scraping allows you to collect diverse types of data, including text, images, and structured data, which can be beneficial for tasks that require multi-modal data or data from various sources.

**Challenges and Considerations**

**Data Quality**: Web scraped data may contain noise, inconsistencies, or missing values that require careful cleaning and preprocessing. The quality of the web scraped dataset heavily depends on the quality of the web scraping process and the data cleaning steps applied afterward.

**Legal and Ethical Constraints**: Web scraping raises legal and ethical concerns related to data privacy, copyright, and terms of service violations. Ensuring compliance with relevant laws and regulations is essential to avoid legal repercussions.

**Data Reliability**: The reliability of web scraped data can vary depending on the website's content, structure, and update frequency. Websites may change their layout or content over time, affecting the consistency and reliability of the scraped data.

**Bibliography**

<https://link.springer.com/article/10.1007/s42979-021-00592-x>

<https://academic.oup.com/jamia/article/18/5/544/829676?ref=https%3A%2F%2Fcodemonkey.link&login=false>

<https://www.sciencedirect.com/science/article/pii/S1474667015330226?ref=pdf_download&fr=RR-2&rr=874420cff9e0b9db>

<https://www.researchgate.net/publication/367719780_Web_Scraping_Techniques_and_Applications_A_Literature_Review>

<https://www.elluminatiinc.com/importance-of-mobile-application-in-everyday-and-business/>

3.4 Tehnologies used

**Introduction to Flutter**

**Zi de design cu material app, mediaquery, navigator, stateful widgets**

Basic Principle: In Flutter, every element on the screen is a widget. This includes simple components such as buttons, text, and images, as well as complex structures like entire screens or even the whole application. Each widget encapsulates specific functionality and appearance.

Hierarchy and Composition: Widgets are organized in a hierarchical structure, forming a widget tree. In this tree, each widget can contain one or more child widgets. For instance, a Scaffold widget (which provides the basic layout structure for an app) can contain an AppBar, a Body, and other elements, each of which is a widget in itself.

Encapsulation and Reusability: By treating everything as a widget, Flutter allows for encapsulation of functionality. This makes it easy to reuse and nest widgets within other widgets, promoting a modular design. For example, a Column widget can contain several Text widgets and Button widgets, each defining its own properties and behavior.

Building the UI: To construct the UI, you start with a root widget and then compose child widgets within it. This creates a parent-child relationship, where the parent widget controls the layout and behavior of its children. For instance, a Scaffold might contain a Container, which in turn might contain a Column with several Text widgets.

Navigation

The components within the application interact with each other and manage application state using Flutter's built-in features: Navigator Functionality: The application leverages Flutter's navigator function to enable seamless navigation between different screens. Each screen, representing a distinct component, is pushed onto the navigation stack when accessed and popped off when the user navigates back. This navigation mechanism ensures smooth transitions between screens and maintains a clear navigation flow. By utilizing named routes and the Navigator widget, the application can efficiently manage screen transitions and maintain a structured navigation hierarchy.