Diplomarbeit

3D Object Tracking

Image-Based 3D Tracking with Multiple Stations

Eingereicht von

Prantl Niclas
Krahbichler Lukas

Eingereicht bei

Höhere Technische Bundeslehr- und Versuchsanstalt Anichstraße

Department of Electronics and Computer Engineering

Betreuer

Götsch Leopold
Egger Eva-Maria
Jank Andreas

Projektpartner

None

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Kurzfassung /Abstract

Eine Kurzfassung ist in deutscher sowie ein Abstract in englischer Sprache mit je maximal einer A4-Seite zu erstellen. Die Beschreibung sollte wesentliche Aspekte des Projektes in technischer Hinsicht beschreiben. Die Zielgruppe der Kurzbeschreibung sind auch Nicht-Techniker! Viele Leser lesen oft nur diese Seite.

Beispiel für ein Abstract (DE und EN)

Die vorliegende Diplomarbeit beschäftigt sich mit verschiedenen Fragen des Lernens Erwachsener – mit dem Ziel, Lernkulturen zu beschreiben, die die Umsetzung des Konzeptes des Lebensbegleitenden Lernens (LBL) unterstützen. Die Lernfähigkeit Erwachsener und die unterschiedlichen Motive, die Erwachsene zum Lernen veranlassen, bilden den Ausgangspunkt dieser Arbeit. Die anschließende Auseinandersetzung mit Selbstgesteuertem Lernen, sowie den daraus resultierenden neuen Rollenzuschreibungen und Aufgaben, die sich bei dieser Form des Lernens für Lernende, Lehrende und Institutionen der Erwachsenenbildung ergeben, soll eine erste Möglichkeit aufzeigen, die zur Umsetzung dieses Konzeptes des LBL beiträgt. Darüber hinaus wird im Zusammenhang mit selbstgesteuerten Lernprozessen Erwachsener die Rolle der Informations- und Kommunikationstechnologien im Rahmen des LBL näher erläutert, denn die Eröffnung neuer Wege zur orts- und zeitunabhängiger Kommunikation und Kooperation der Lernenden untereinander sowie zwischen Lernenden und Lernberatern gewinnt immer mehr an Bedeutung. Abschließend wird das Thema der Sichtbarmachung, Bewertung und Anerkennung des informellen und nicht-formalen Lernens aufgegriffen und deren Beitrag zum LBL erörtert. Diese Arbeit soll

einerseits einen Beitrag zur besseren Verbreitung der verschiedenen Lernkulturen leisten und andererseits einen Reflexionsprozess bei Erwachsenen, die sich lebensbegleitend weiterbilden, in Gang setzen und sie somit dabei unterstützen, eine für sie geeignete Lernkultur zu finden.

This thesis deals with the various questions concerning learning for adults – with the aim to describe learning cultures which support the concept of live-long learning (LLL). The learning ability of adults and the various motives which lead to adults learning are the starting point of this thesis. The following analysis on self-directed learning as well as the resulting new attribution of roles and tasks which arise for learners, trainers and institutions in adult education, shall demonstrate first possibilities to contribute to the implementation of the concept of LLL. In addition, the role of information and communication technologies in the framework of LLL will be closer described in context of self-directed learning processes of adults as the opening of new forms of communication and co-operation independent of location and time between learners as well as between learners and tutors gains more importance. Finally the topic of visualisation, validation and recognition of informal and non-formal learning and their contribution to LLL is discussed.

Gliederung des Abstract in **Thema**, **Ausgangspunk**, **Kurzbeschreibung**, **Zielsetzung**.

Projektergebnis Allgemeine Beschreibung, was vom Projektziel umgesetzt wurde, in einigen kurzen Sätzen. Optional Hinweise auf Erweiterungen. Gut machen sich in diesem Kapitel auch Bilder vom Gerät (HW) bzw. Screenshots (SW). Liste aller im Pflichtenheft aufgeführten Anforderungen, die nur teilweise oder gar nicht umgesetzt wurden (mit Begründungen).

CCA - COMPETENCE CENTRE
HTL Anichstraße

Erklärung der Eigenständigkeit der Arbeit

EIDESSTATTLICHE ERKLÄRUNG

Ich erkläre an Eides statt, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst, andere als die angegebenen Quellen und Hilfsmittel nicht benutzt und die den benutzten Quellen wörtlich und inhaltlich entnommenen Stellen als solche erkenntlich gemacht habe. Meine Arbeit darf öffentlich zugänglich gemacht werden, wenn kein Sperrvermerk vorliegt.

Ort, Datum Verfasser 1

Ort, Datum Verfasser 1

Inhaltsverzeichnis

1 Einleitung

In der Einleitung wird erklärt, wieso man sich für dieses Thema entschieden hat. (Zielsetzung und Aufgabenstellung des Gesamtprojekts, fachliches und wirtschaftliches Umfeld)

1.1 Vertiefende Aufgabenstellung

1.1.1 Schüler*innen Name 1

1.1.2 Schüler*innen Name 2

1.2 Dokumentation der Arbeit

Es werden die Projektergebnisse dokumentiert

- Grundkonzept
- Theoretische Grundlagen
- Praktische Umsetzung
- Lösungsweg
- Alternativer Lösungsweg
- Ergebnisse inkl. Interpretation

Weitere Anregungen:

- Fertigungsunterlagen
- Testfälle (Messergebnisse...)
- Benutzerdokumentation
- Verwendete Technologien und Entwicklungswerkzeuge

2 Market Analysis

2.1 Industry Overview and Market Potential

Drones are transforming agriculture by offering innovative solutions to enhance efficiency and sustainability. As reported by Rachel (2021), companies like CO2 Revolution are using drones to plant seeds in inaccessible areas, showcasing the potential of drone technology in reforestation and agricultural applications.

The global agricultural sector faces significant challenges, including the need to increase food production to meet the demands of a growing population and to address climate change impacts (Dmitry Nazarov & Kulikova 2023). Traditional farming methods are often insufficient, leading to a surge in the adoption of drones for various agricultural purposes.

2.1.1 Applications of Drones in Agriculture

Drones are utilized in agriculture for a wide range of applications:

- **Crop Monitoring and Mapping:** Drones provide high-resolution aerial imagery, enabling farmers to monitor crop health, identify pest infestations, and assess soil conditions in real-time (Dmitry Nazarov & Kulikova 2023, Sachin Wankhede 2021).
- **Precision Spraying:** Equipped with advanced navigation systems, drones can apply fertilizers, pesticides, and herbicides precisely where needed, reducing chemical usage and minimizing environmental impact (Agriculture n.d., Chin 2023).

- **Irrigation Management:** Drones assist in detecting variations in soil moisture levels using thermal sensors, helping optimize irrigation systems and conserve water resources (Dmitry Nazarov & Kulikova 2023).
- **Planting and Seeding:** Some drones are designed to plant seeds over large areas efficiently, particularly useful in reforestation efforts and hard-to-reach terrains (Rachel 2021).
- **Data Collection and Analysis:** Drones gather extensive data that, when processed with advanced analytics, provide actionable insights for improving crop yields and farm management practices (Choacan Xiang 2023).

2.1.2 Market Growth and Potential

The agricultural drone market is experiencing significant growth. Valued at $0.88 billion in 2020, it is projected to reach $5.89 billion by 2030, with a compound annual growth rate (CAGR) of 22.4% (Sachin Wankhede 2021). Key factors contributing to this growth include:

- **Demand for Increased Food Production:** Global population growth drives the need for higher agricultural output, encouraging the adoption of efficient technologies like drones (Dmitry Nazarov & Kulikova 2023).
- **Technological Advancements:** Improvements in drone capabilities, such as enhanced sensors and longer flight times, make them more practical for agricultural applications (Agriculture n.d.).
- **Adoption of Precision Farming Techniques:** Farmers are increasingly utilizing drones for site-specific crop management to optimize resource use and increase yields (Sachin Wankhede 2021).

2.1.3 Challenges and Opportunities

While the potential is significant, the adoption of drones in agriculture faces several challenges:

- **Regulatory Barriers:** Strict government regulations on airspace and drone operations can hinder deployment (Dmitry Nazarov & Kulikova 2023).
- **High Initial Costs:** The expense of acquiring and maintaining advanced drones may be prohibitive for small-scale farmers (Sachin Wankhede 2021).
- **Technical Skills Requirement:** Effective use of drones demands specialized knowledge, which may not be readily available in all farming communities (Choacan Xiang 2023).

Opportunities to address these challenges include:

- **Government Support:** Initiatives like Austria's SSmart Farmingäction plan aim to integrate digital technologies into agriculture, providing funding and resources to farmers (Bundesministerium für Land-und Forstwirtschaft 2023).
- **Technological Innovations:** Developing user-friendly and cost-effective drones can lower barriers to entry (Agriculture n.d.).
- **Education and Training:** Implementing programs to educate farmers on drone technology enhances adoption and effective utilization (Dmitry Nazarov & Kulikova 2023).

2.2 Target Group Definition

Our ideal customers are medium to large agricultural enterprises, service providers, and technology companies focused on modernizing agriculture with drone technology.

Key Characteristics

- **Demographics**: Decision-makers aged 35–60 with higher education in agriculture or business management, often fitting the 'Progressive Realists' or 'Adaptive Pragmatic Middle' Sinus-Milieus Institut (n.d.).
- **Geographics**: Located in agricultural regions such as Lower Austria, Styria, and Upper Austria.

- **Psychographics**: Innovation-oriented, value efficiency and sustainability, open to new technologies.
- **Behavioral**: Research thoroughly before purchases, attend industry events, rely on professional networks.
- **Needs**: Affordable, reliable drone tracking systems to optimize farming operations.
- **Technographics**: Moderate to high technological proficiency, use agricultural management software, active on professional forums.

2.3 Buyer Personas

Persona 1: Thomas Bauer

- **Age**: 52
- **Role**: Owner of a large family farm
- **Location**: Lower Austria
- **Goals**: Increase crop yields and efficiency through technology
- **Pain Points**: High costs of advanced drones; needs affordable tracking solutions
- **Behavior**: Reads industry news, attends agricultural fairs, values practical solutions

Persona 2: Maria Hofer

- **Age**: 40
- **Role**: CEO of an agricultural technology service provider
- **Location**: Graz, Styria
- **Goals**: Expand services with cost-effective drone solutions
- **Pain Points**: Requires reliable tracking without expensive onboard equipment
- **Behavior**: Active on LinkedIn, follows industry trends, seeks scalable solutions

Persona 3: Andreas Schneider

- **Age**: 55

- **Role**: Government agricultural advisor
- **Location**: Vienna
- **Goals**: Promote sustainable farming practices using new technologies
- **Pain Points**: Finding cost-effective solutions for widespread adoption
- **Behavior**: Reads policy papers, influences procurement decisions, values ecological responsibility

2.3.1 Competitor Analysis

The 3D object tracking market in Austria, while nascent, is witnessing increasing competition due to the rising demand for automation, immersive experiences, and enhanced security across various sectors. The following analysis focuses on three key competitors, considering their relevance to the Austrian market Insights (n.d.):

1. **Vicon (UK):** A well-established player in motion capture, Vicon's influence extends across Europe, including Austria. They cater to diverse industries, particularly those requiring advanced motion capture and analysis. Their solutions are known for high accuracy and versatility, but the associated high cost might limit their accessibility for some customers Ltd (n.d.).
2. **Qualisys (Sweden):** Qualisys offers sophisticated motion capture systems with a strong presence in research and development sectors within the EU. Their focus on precision and data quality makes them attractive for scientific and engineering applications. However, their solutions might be less suitable for cost-sensitive or less technically demanding use cases Qualisys (n.d.).
3. **ViewAR (Austria):** A key player in Austria's AR and 3D technology landscape, ViewAR specializes in augmented reality solutions, integrating 3D tracking and object recognition. Their focus on AR applications and local presence gives them an advantage in understanding the specific needs of the Austrian market ViewAR (n.d.).

Competitive Landscape

The Austrian 3D object tracking market is characterized by a mix of international players like Vicon and Qualisys, who bring their established expertise,

and local companies like ViewAR, who offer specialized solutions. The competitive landscape is still evolving, with opportunities for new entrants offering innovative and cost-effective solutions.

Our Differentiation and Positioning

Our 3D object tracking system distinguishes itself by providing a markerless solution that leverages computer vision and multiple calibrated ground stations. This approach offers a combination of accuracy, flexibility, and affordability, addressing the limitations of existing systems.

We position ourselves as a provider of an innovative and accessible 3D tracking solution that empowers businesses and individuals across various industries. Our target customers are those seeking a flexible and reliable tracking system that doesn't require specialized markers or reflectors, particularly in the industrial automation, AR/VR, security, and autonomous systems sectors within the Austrian market.

2.3.2 Conclusion

The market analysis highlights a promising opportunity for our 3D object tracking system, driven by growing demand in industrial automation, AR/VR, security, and autonomous systems. Our markerless, multi-station approach differentiates us from competitors, offering accuracy, flexibility, and affordability. Further research will refine our understanding of target customers and ensure a successful market entry.

3 Latex-Beispiele

3.1 Aulistungen

- *Kursiv* Text 1
- **Fett**
- TT

Dasselbe durchnumeriert:

1. *Kursiv* Text 1
2. **Fett**
3. TT

3.2 Tabellen

Eine Tabelle mit Testdaten:

position	mean	median	sd	min	max
6	6.89	5.61	7.29	0.31	160.12
9	5.35	4.39	4.94	0.18	76.40
12	8.70	6.96	10.72	0.15	239.88
13	9.01	7.54	7.60	0.15	138.86
15	8.18	6.99	6.86	0.16	117.26
16	5.26	4.42	4.99	0.08	110.21
17	5.87	4.79	6.13	0.15	98.88
36	8.21	6.72	7.58	1.36	122.35
42	6.77	5.93	6.98	1.72	123.72
43	6.27	5.53	3.21	0.57	35.69

Tabelle 3.1: Eine Tabelle mit Testdaten

Sprachen wie z.B. **R** können Latex-Tabellen exportieren, sie müssen also nicht immer so aufwändig formatiert werden.

3.3 Abbildungen

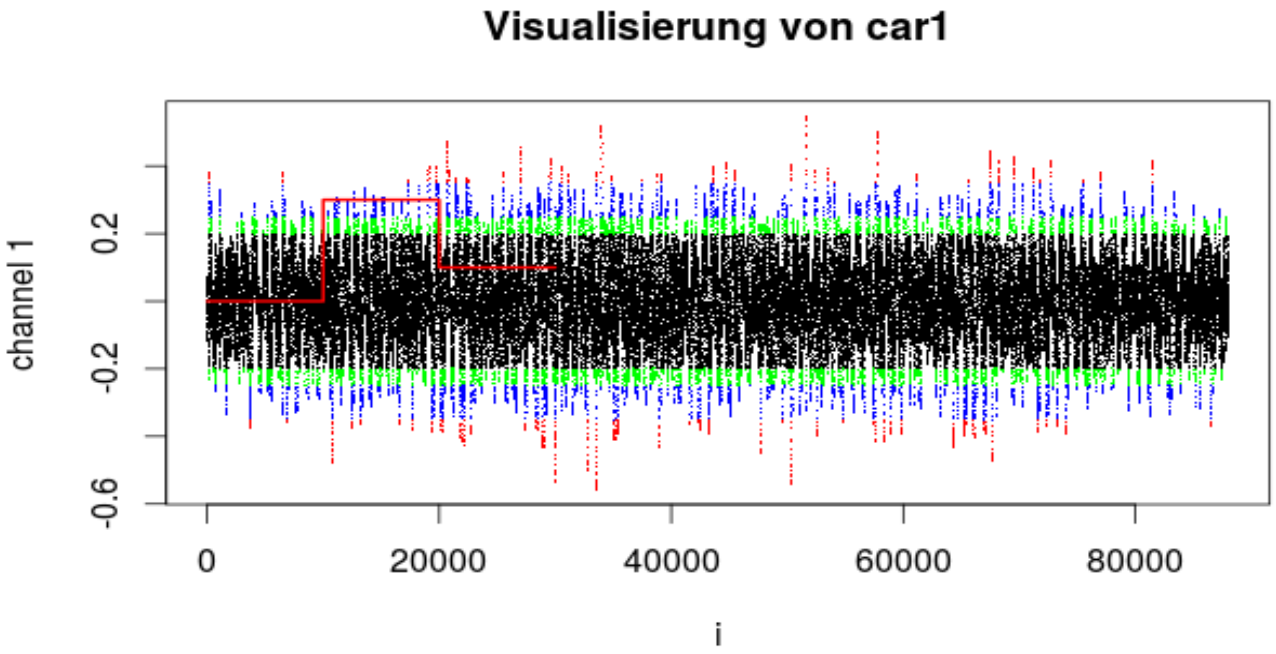

Abbildung 3.1: Ein Beispiel für ein Bild

3.4 Quellcode

Quellcode wird automatisch (mit der Möglichkeit die Sprache anzugeben) formatiert und in das Listings-Verzeichnis gegeben:

3.4.1 Java-Code

```
1 int i = 1;
2 float f = 2;
```

```
3 System.out.printf("Int-Z %d Float-Z: 52f",i ,f );
```

Listing 3.1: Java-Beispiel

3.4.2 Python-Code

```
1 #Hier ein kleines Beispiel in Python
2 lower = 0
3 upper = 10
4 for i in range(lower,upper):
5 print(i)
```

Listing 3.2: Python-Beispiel

3.4.3 Lesen von Dateien

Es kann auch direkt von Dateien gelesen werden:

```
1 public class First {
2
3   public static void main(String[] args) {
4     for (int i = 0; i < 10; i++) {
5       System.out.println(i);
6     }
7   }
8 }
```

Listing 3.3: Java-Beispiel von Datei

3.5 Referenzen

Beispiele für die Verwendung von Referenzen:

- Wie in Tabelle 3.1 ersichtlich...
- Wir sind im Kapitel 3
- In Zeile 2 im Listing 3.3

3.6 Zitate

Hier das Zitat eines Buches: **?** Wird alles automatisch mit bibtex erledigt.

Appendix

Tabellenverzeichnis

Abbildungsverzeichnis

Listings

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