



United AI e.V.

United AI is a club, founded by one of the first students of the new major "artificial intelligence" at TH Deggendorf. Our main objective was to provide new possibilities and opportunities to all students. While most of our members are studying artificial intelligence, we have already gained some students from different majors. Through creating an innovative image, we have already gained access to multiple high-performance workspaces (Deep learning lab) and a coworking space with many start-ups and companies to widen our network (ITC1 building). These will

drastically increase our growth since we can progress much faster with our projects and we already have multiple platforms to promote ourselves and ask for help. Since the start, we have divided our club into four main branches. Those help us to better organize events and create a community for all kinds of interests. The first branch is our social branch "Students for students". As the name already suggests, the students work to create resources or opportunities for others to learn. Its focus lies upon creating workshops, newsletters, articles, and more. The second branch is called "Algorithms". It focuses on projects based on complex and innovative algorithms. We have started two projects under its name, "AI Merch" and "Reinforcement learning". The teams are trying to implement new and creative methods for their respective fields. The third branch "Robotic" focuses more on the human-machine interaction. As for now, we have a project to create our own "AI Assistant" running. The main goal is to support new members and make the interactions throughout our club more futuristic. The last branch is probably the most intuitive and interesting. It is our own "Smart City" branch. Deggendorf and Plattling are part of the Bavarian "Smart City Smart Region" project. The basis for this in Deggendorf will be the Integrated Digital Development Concept (IDEK). The IDEK-Project will be a strategic compass and a toolbox with smart and evaluated concepts that will make Deggendorf and Plattling fit for the future as sustainable, social, and economically strong cities with a high quality of life. United AI is part of IDEK. The club is responsible for the AI-based implementations of Smart City in Deggendorf and has a "crucial role in the IDEK project" – Plattlinger Anzeiger. All of these branches combined demonstrate our will to create a resourceful and open-source community. We want people to gain knowledge and share their knowledge. At the same time, we try to help startups and other sponsors as well as we can.

To gain a better understanding of how our projects are structured and how we work we will now go into more details about the different topics.

As we are a non-profit club the social aspect is very important to us. That's why we created the project students for students as the backbone of our club. Its main objective is to collect knowledge and distribute it in a fun and easy way. The main goal is to create a general platform, usable for all our members. This platform combines all our knowledge of members who like to share and provides each student a unique possibility to study at their own pace. This would be achieved through exercises, small exams, and even an AI, that keeps track of your mistakes and reacts to them. For now, we focus mainly on gathering knowledge. Our first goal is to create a workshop around the platform "git", its uses, advantages, and disadvantages. Each student will receive small exercises and the instructors will guide them to the best solution. After each workshop, the results will be collected and used as data for our future evaluation-AI. The platform itself will have a record of all recordings, workshops, etc, and will guide students towards better marks through artificial intelligence. Collecting and sharing knowledge is the groundwork for our second branch which is all about algorithms. This branch takes it one step further, not only collecting but using the knowledge to create.

The first project has the goal of generating interesting and good-looking merchandise with the help of artificial intelligence. The innovation aspect is that Consumers will be able to create interesting and unique designs by themselves, with the assistance of AI. The way this works is that we have trained a Neural network to be able to generate images using many input parameters. These parameters can be adjusted by a person, leading to a unique design. Due to computational restrictions, the Network only outputs a small image, so we combine multiple images to be able to cover any area. The borders of the images are blurred, in order to not create a clearly tiled look. The greatest challenge is that it takes a lot of time to gather a reasonably sized dataset and to make sure that the learning curve of the Neural Network doesn't drop to 0. To combat the disappearing learning rate, we researched different methods to improve the learning rate, such as using a Residual Network, instead of a simple Neural Network. Looking forward, we plan to expand the dataset, research more efficient Network structures and make the process for creating your own images more user-friendly.

The second project in our algorithm branch is about creating agents for special tasks.

Reinforcement learning is playing an increasingly important role in modern life and Industry 4.0. especially dynamic processes are often difficult to optimize in a classical way. The club project "Reinforcement Learning" takes on this task and will develop practical applications with the help of self-reinforcing learning for such processes.

Furthermore, the project also includes the task of facilitating the introduction of beginners to the topic of reinforcement learning.

The current status is to get familiar with state-of-the-art methods and algorithms and to try them out on simple programs like a pole cart or 2D "jump and runs".

After getting an overview of the current approaches, we will deepen the skills we have learned by developing our first own agent. This agent will learn to play chess on its own.

In parallel, we will collect and prepare what we have learned to help new project members get started with reinforcement learning.

However, these are only the intermediate steps to work towards a joint project with the club team "Smart Deggendorf". A big role in the club is to bring forward innovative and new technologies.

Therefore, in this future project, we would like to optimize the road traffic of the city of Deggendorf by installing a smart traffic light system. For this purpose, the "Reinforcement Learning" team will take care of the program code that makes the traffic lights intelligent, so that they provide the optimal red or green phase for the respective traffic situation.

Reinforcement learning plays a significant role in era 4.0, that is why we are optimally prepared with this club project to help shape the future.

Next to implementing algorithms we also want to look into fields like robotics. That is why our third branch is all about human-machine interaction.

The Project AI Assistant is working to create an intelligent assistant that is able to answer diverse questions about the club and the university.

The completion of this project will help us to accelerate the information sharing between projects and add a lot of transparency to outsiders of the club, with this transparency everyone can always check what we are up to and therefore is more intrigued into joining us.

Next to Rasa (Chatbot framework), we started to develop our own framework. To write a good foundation we created first a word-spotter. The algorithm is made to be extendable and will be optimized in the future with frameworks like TensorFlow.

In the meantime, another team is working on the back end. We were able to create a website and discord bot with a docker to connect them to the bot once it is in a testable phase. These would be our main user interfaces to help users get started in our club.

In the future, we can aim to have our first steps with the bot and link him to a database that relates to other projects to be able to answer questions related to them.

In the far future, this AI framework will be used for other projects and can be called the first United AI Assistant framework, but until we reach that stage, we have a lot to learn.

Our last branch is probably the most applied one. Its aim is to help the citizens of Deggendorf in their everyday lives by cooperating with the city and participating in the smart Deggendorf project.

To implement properly Artificial Intelligence, we need data. For data generation, we started with two projects - The Deggendorf App and the LiDAR project.

Deggendorf App - We are working on an app for mobile devices. The app should be an information platform in which specific data for Deggendorf can be retrieved. Information such as the weather, popular bars/restaurants, water levels in the rivers, news, snow depths in the surrounding area for cross-country skiing, and many more.

The app should be customized to be user specific. Bars/clubs should be able to call events and individual users should be able to draw attention to topics in Deggendorf.

Machine learning can be applied to anonymous user data. The quality of the results will strongly depend on the number of users.

LiDAR Project - The LiDAR project is based on an RS-LiDAR 16. From the high-frequency 3D point clouds we want to use image recognition to detect cars, cyclists, and people(anonymous). The LiDAR sensor is intrinsically privacy compliant, i.e., no recognition of faces, license plates, etc. is possible. For the implementation, we use the framework ROS2. To train a neural network we first need training data.

It would be possible in the future to provide a digital twin with real-time data and then predictions and simulations could be applied. Diverse and flexible smart city applications will become possible.

The dream outcome would be to keep all these branches as separately operating projects, who can work together on joined projects and share their knowledge through our club infrastructure.

As for now, we have mainly relied on virtual experiences for teambuilding. We would like to adapt this after the pandemic to organize events around different work environments and excursions. The first step, getting in touch with different Start-Ups and companies is already accomplished, now we mainly want to actively work with and for them to brighten our horizon in terms of possibilities in the near future.