

# Al operating ropeways: The transformation from operator experience to Al

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#### Chairlifts operated by AI in the 2024/2025 season



#### Chairlifts operated by AI

In order to operate a ropeway station without personnel it is necessary to cover the operator's tasks by alternate means.

Operator tasks including but not limited too:

- Monitor incoming chairs
- Monitor unloading procedure and react to diverse situations
- Stop passengers from leaving dedicated unloading zones and entering dangerous areas of the station
- Communicate with passengers and provide assistance
- Start up ropeway after system or passenger related shutdowns
- React to changing environmental circumstance like Wind and Weather



Wind monitoring in close proximity to AURO station

Automatic detection of carrier swing

Pressure sensitive mats detect occupants involuntarily exiting the chair ahead of the unloading area



Safety gates detect passengers leaving dedicated unloading areas

Passenger intercom systems and stop buttons enable passengers to communicate with ROC or take direct action of ropeway movement





















Computer vision algorithms monitor the exit area via multiple cameras

#### **Cameras and Al**

- Monitor the exit area 15 times per second
- Have an optimal view from multiple viewing angles to capture every possible scenario
- Detect misbehaving passengers in the exit area
- Decide between safe or unsafe situations and the required system reaction, slow down or emergency stop
- Communicate the decision directly to the control system to trigger an instant reaction

• **and** they are improved with the data they capture with every operating hour at every station



### Development of AI for ropeways at Mantis

2018-21	2021	2022	2023	2025
Data collection on numerous chairlifts First real-time prototype in Davos	Two fully integrated test systems in Wildhaus and Silvretta Start of parallel operation with Mantis system in the background	Fully autonomous operation with staff in the background supervising operation	Permits received by A/CH authorities to operate unattended chairlift terminals	Successful season with eight fully autonomous uppe terminals on chairlifts in A/CH

#### Al algorithms require large amounts of data

3.5M

Passengers getting off a chairlift have been manually annotated for the initial training of the algorithms

21

Chairlift stations have been equipped to capture video data to learn from every possible lift configuration >20M

8

Passengers have been accompanied through their unloading process by AI so far

Chairlifts have fully autonomous top stations now and continue to contribute to the dataset

#### Development

Operation

### Experience through supervised operation

- For two season the system was running in parallel to the operators at two test installations in Wildhaus and Silvretta (2021-2023)
- Reactions and reaction times from human operators were compared with AI generated reactions
- Reactions from the system were evaluated by the human operators
- Critical situations were discussed with operators with decades of experience
- Their evaluation was aimed to be mirrored by the system reactions
- Challenge: Standardise the evaluation based on station configuration, chairlift speed, capacity, etc.





#### Life cycle of an AI system in operation



#### **Advantages**

- Continuous improvement: Every new station and every new season provides experience for even more targeted reactions
- Quality control: Every situation can be rewatched and evaluated by a human
- Testing: Possibility for complete testing based on videos of the past

#### Status quo 2025

# 27'000

Operation hours of real-time operation for the AI software and its engineers to gain experience

0

Dangerous accidents due to system failure or wrong evaluation of a situation

# 8'000

Operating decisions communicated to a ropeway control system resulting in a slow or stop

8/8

operating teams are satisfied with the performance and availability of the system

#### Al operating ropeways - today and tomorrow

- Al will play a big role in the future of the ropeway industry and is already operating chairlift terminals today
- Al systems require huge quantities of data and operating experience and are not developed over night
- Chairlift upper terminals are only the beginning, the ropeway operation holds many more use cases

