Project quotation

The projects intention is to create a video tracking solution which can identify and follow customers path in a small store. The project solution provides the customer tracking framework for a cashierless store, and when connected to a product identification and tracking system, the solution can cut employment cost, raise customer satisfaction and provide a technological advantage over the competitors who do not have a similar system.

We are planning with 20 cameras in this quotation, but this number can change based on the assignment and what the optimal solution is. The video material is collected first, then sent to an API to get back data on the customer, id, path and actions.
The delivery includes a Machine Learning algorithm, to identify, track and keep an account of the customers actions and the list of what they bought, plus to provide an API link where the real time collected data should be sent for analysis of the AI model.

Project outlines

Identified tasks.

Task	Complexity	Description	Considerations
Requirement analysis	Medium	Careful planning stage about what are the requirements of the model, the accuracy, the scale, the hardware and the data quality.	-Domain expert from the customers side must be involved. -Concrete expectations, deadlines and evaluation goals need to be set.
Train object detector and ReID algorithm	Hard	Gathering training data and training an object detector and ReID algorithm on it.	- Data needs to be relevant, correctly labeled, diverse and include edge cases. - Data needs to be relevant to the hardware we will be using. - Consider using existing OD and ReID solutions.
Create tracking algorithm and merge between cameras	Medium	Developing an identification solution, which can track a person through the whole store using several cameras.	- Consider using existing tracking solutions. - By this time consider the accuracy of the prototype system, and see if the goals are realistic and reachable.
Develope API	Medium	Developing the necessary network system for the on-site hardware to communicate with the id and tracking algorithms.	-Consider the circumstances of internet connection on site compared to the amount of data traffic. - Consider the scale of the API system (1 store or 1000 stores)
Improvement of algorithms and API	Medium	Further improving both the models and the communication between the hardware and the models based on customer feedback on prototype.	-Make clear and consensus-based priorities, first implement / improve the necessary components, and add extra features after. - Constantly monitor the systems performance - Have a backup, in case of unsuccessful “improvements”.

Identified risks.

Risk	Cause	Effect	Countermeasure
Prolonged project duration	Preliminary metric results are not sufficient.	More time/resources allocated away from other parts of the project.	Set very clear timeframes and a minimum expected requirement for the project, based on a metric that makes sense for our purpose. If the requirements are not met until the timeframe, we move on to another project.
Low model accuracy	Low model quality, low quality training/inference data.	Model sends wrong bill to a person	Diversifying the training data (skin color, seasonal clothes, different lighting), including edge cases and in-store images.
Choosing the wrong metric	Evaluating models on wrong metrics can have very undesirable effects in inference.	We might end up choosing a metric which does not represent our case and question well, and thus leads us to succeeding at the wrong question and failing to answer the right question.	Careful planning and communication about what metrics are important to our case and why will help to deliver a relevant model solution to our question.
Legal issues	GDPR : The EU market has strict regulations about how online data, and information about people is stored and processed.	Limited amount and quality of data available to use, and constant legal considerations. Slows down our process and limits our possibilities, creates disadvantage compared to companies in other regions.	Discuss with legal team what is exactly allowed and what is not. See if our products terms could include data storage. Find a solution to anonymize the people in inference stage.
Lack of quality in training data	If our training data is badly labelled, the model will learn ambiguous or wrong answers. If the data has low variety, the model will have a narrow knowledge of the subject.	Our model will be much less successful in doing its job on a variety of unseen data, ex.: people in different clothes based on time of the year.	-Aim to find varied datasets online. -Purchase a dataset. -Create own dataset and annotations. -Start to collect data from the store ASAP to help the model learn the local patterns.

Requirements from the customer

Requirement	Value	Request
A responsible contact person in the company.	The project status can be updated and discussed, plus system critical questions can be asked from the domain experts / representatives.	At least one domain expert person from the customers who is accessible during the project.
Access to the store facilities	By accessing the store facilities, the team can familiarize themselves with the circumstances and plan ahead accordingly, plus try mock-ups and prototypes on site.	Access to the store at pre planned times. Access to the store at night according to pre-planned times (max 10 times).
Accepting guidelines about camera, lighting and store layout specifications	By conforming to the recommended picture quality, lighting and store layout requirements, we can drastically increase the success chance for our project.	Cameras should be able to record 1920*1080-pixel size images, 30 frames per second. The camera focus area has to be well lit, with a minimum of 500 lux. Store layout needs to be grid-like or laid out by mutual agreement (or eventually raise the number of cameras.

Delivery requirements

Requirement	Value	Test method
High accuracy on identifying a person	Lower limit = 98%	10x1 minutes test on a recorded video with single and multiple people. 3x5 minutes test on a live video with multiple people. Different time of day, types of clothing and ethnicity must be tested.
High precision (based on frame-by-frame bounding box proximity) and low latency of reidentification	Lower limit for precision = 98% Higher limit for latency = 0.5s	10x3 minutes test on a recorded video with single and multiple people. 10x3 minutes test on a live video feed, preferably on-site with multiple people. Different time of day, types of clothing and ethnicity must be tested.
Person tracking with low track fragmentation, high correctly detected track	Higher limit for fragmentation= 4 (we “lose” track of a person maximum 3 times, that creates 4 part of the same track). Lower limit for correctly detected track = 95%	10x3 minutes test on a recorded video with single and multiple people. 10x5 minutes test on a live video feed, preferably on- site with multiple people. Different time of day, types of clothing and ethnicity must be tested.

Deliveries

#	Delivery	Delivery date	Handover
D1	Demo on video with single camera	1/4/2023	Object detection-; ReID-; Interaction detection-; Tracking algorithms working on a live camera feed.
D2	In-store PoC	1/7/2023	Merging the tracks between several cameras. Up and running cloud pipeline and API. Previous algorithms are fine-tuned. The prototype system deployed on site in one store.
D3	Beta release	1/10/2023	Further improvement of the deployed algorithms. Evaluation of the system happens live. Improving infrastructure before coming scale-up.
D4	Release v1.0	1/1/2024	Delivery of the system to many stores. Providing cloud pipelines and API access on scale. Crash-course on the system, its importance and application for the client.

Project cost

Description	Amount	Price per unit	Price
Requirement analysis (1 week – 1 pers)	40 h	1,000 kr	40,000 kr
Data exploration (4 weeks – 4 pers)	640 h	1,000 kr	640,000 kr
Least effort model training (5 weeks – 3 pers)	600 h	1,000 kr	600,000 kr
Feasibility check (2 week – 2 pers)	160 h	1,000 kr	160,000 kr
D1 Delivery	1440 h		1,440,000 kr
Model improvement (6 weeks – 3 pers)	720 h	1,000 kr	720,000 kr
Proof-of-concept installation (6 weeks – 3 pers)	720 h	1,000 kr	720,000 kr
D2 Delivery	1440 h		1,440,000 kr
Model improvement (12 weeks – 2 pers)	960 h	1,000 kr	960,000 kr
D3 Delivery	960 h		960,000 kr
Model improvement (12 weeks – 2 pers)	960 h	1,000 kr	960,000 kr
D4 Delivery	960 h		960,000 kr
	Total price:		**4,800,000 kr**

Other project costs:

- Cost table does NOT include the cloud data storage / data download and cloud computing costs.
- Cost for the hardware (cameras), and their installation costs are not included.
- Cost for a product identification and purchased product tracking is not included.