ULTINOUS

Queue management with alerting: no more long queues while shop revenue increases

How to increase user experience and buying willingness with optimized staff resource

Ultinous Video Analysis Platform

CASE STUDY

Case study

Based on the Ultinous Video Analysis Platform we implemented an end-to-end queue management system for a large retailer in Hungary. The queue management system uses security camera feeds as input and runs the video analysis modules to accurately assess store state. Based on the observations a controller model sends alerts to store staff to open or close tills to minimize queuing time. This system has been deployed and tested in a retail store with over 2,500 visitors a day. Careful evaluation showed that the system resulted in a substantial drop in queue length and a disappearance of abandoned baskets. It also resulted in a significant revenue increase without using additional resources.

The problem

The client claimed they had an issue with long queues and wanted to not only measure but decrease the queues. Long queues are a big issue in many retail stores resulting in loss of potential customers every day. Shorter queues result in a better customer experience and increased store revenue.

The store is located in a large shopping mall which is open for 12 hours with 5 cash registers and approximately 2,500 visitors a day. Cashiers in the store are skilled in various tasks, it is possible to allocate resources between tills and other activities in real-time to achieve optimal resource utilization.

The solution

We deployed 5 pieces of 2MP IP cameras in the store: one watching the entrance and others watching the tills and queues in front of the tills. The entrance camera frame rate was set to a higher FPS and all the others to 1 FPS with all the feeds transferred in real-time to a data center. The store upgraded its internet connection to have a guaranteed upload bandwidth and in order to secure the streams an IPSEC connection was made between the store and the data center. Ultinous has large, multi-GPU servers in the data center where we run the video processing system. (Actual processing of these 5 streams requires only a small portion of one Titan X Pascal GPU.)

We ran head detection and anonymization on all streams and stored anonymized video data for two weeks. To detect cashiers and queues we defined regions of interests (ROI) for each cashier and the queuing areas. Total queue size is simply adding up the number of persons detected in each queuing ROI.

Crossing line counter in the retail store. Head detector extended with tracking is capable of counting incoming and outgoing traffic with over 99% accuracy even in a crowd situation.

One of the key parts of our queue management solution is to accurately track incoming and outgoing traffic. Unlike most vision-based counting systems we don't use vertically facing down cameras. Instead, we use a camera that watches a certain store area from a horizontal plane of 10-30 degrees (see example frame). This setup allows using the video stream for many other purposes such as demographics, person re-identification and face recognition. Enter and exit events are booked when the track crosses a predefined crossing line, shown in yellow on the figure above. The system uploads observation data to our database in hourly chunks.

When a new customer enters the store, the alerting system must be able to predict when the customer will arrive in the queuing area. To do this we measured dwell-time distribution with the person re-identification module. The person re-identification algorithm uses full body features (hairstyle, clothing, etc.) to identify the same person from different angles on different camera views or to match incoming and outgoing customers on the same camera view. A predictive alerting logic takes all the observations and alerts cashiers if the throughput needs to be increased. The system generates approximately 20-30 alerts a day.
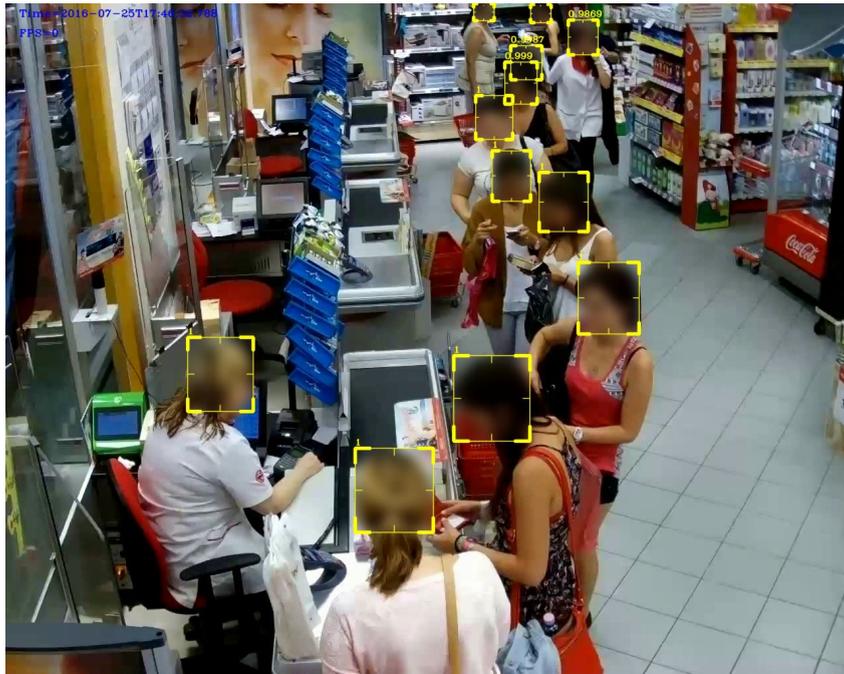
Example video frame and detection for queue length measurement in the retail store.

Results

We ran the system without alerts for a month to observe baseline queue length statistics. When we turned on the alerting feature the queue situation in the store changed significantly. Figure below shows the probability distribution of long queues before and after the alerting was turned on. The revenue of the store has increased substantially and baskets were no longer abandoned. Figure on next page shows how the number of long queues changed after introducing Ultinous Queue Alerting.
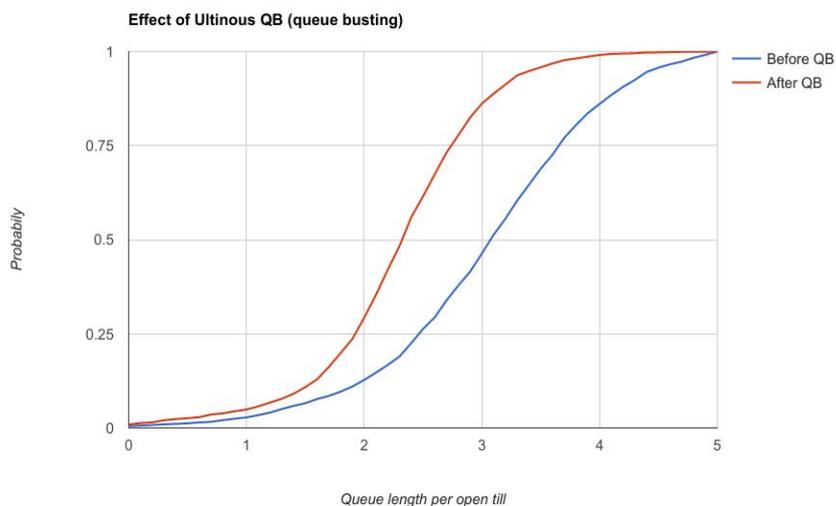
Cumulative distribution function of measured queue length before and after alerting. Measured one month without alerting (blue) and one month with alerting (red).
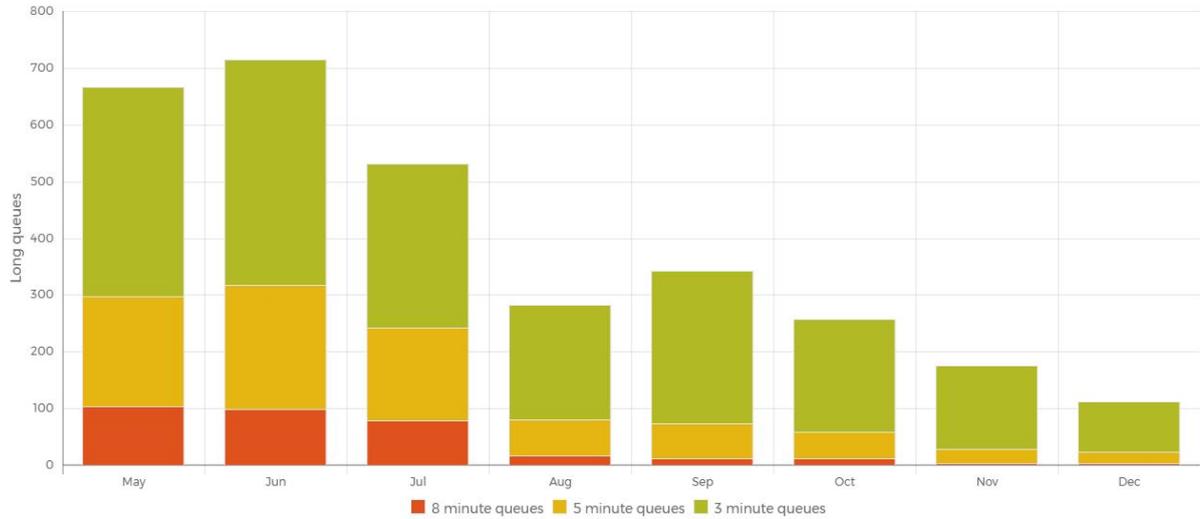
Long queues after introducing Ultinous Queue Alerting in August

About Ultinous

At Ultinous we provide intelligent video analytics technology to improve your products and services or build great new things. Our image and video recognition technology is made easily accessible by a clean API, empowering developers all over the world to build a new generation of intelligent applications.

About Ultinous Retail

The Ultinous Retail Platform leverages cutting edge Artificial Intelligence and Deep Learning, which means shopper patterns can be assessed in real time. Alerting methods depend on the individual store requirements. Ultinous Alert Platform can be implemented easily and cost effectively using the existing CCTV infrastructure into several to thousands stores. Ultinous Alert data can be easily combined with existing analytic information.

Contact

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As of confidentiality reason pictures used in this business case has not been taken on the Partner's premises.