MASTER THESIS Finding Field of View Overlap by Motion Analysis
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Picture analysis free approach for finding shared field of view between network cameras

POPULAR SCIENCE SUMMARY **Fredrik Sydvart, Hampus Altvall**

Network cameras has significantly increased in the recent years. Each camera is independent and its monitoring task can easily be remotely altered. This work focuses on increasing effectiveness of a system of cameras by adding additional knowledge on top of the system and by utilizing multiple cameras when a shared field of view has been found.

With the rise of network cameras over the years, human operators responsible for monitoring is flooded with cameras. In order to filter out relevant information, intelligent software analyzing video streams becomes more important.

If a terrorist is moving in one camera, and the terrorist's face is not shown in the camera, an operator might desperately look if there is another camera nearby monitoring the same object. This relies on that the operator knows the camera environment. For instance, the city. We present an approach where cameras automatically figures out which camera shares the same field of view, that is, what a camera is seeing, with another camera. In this way, the operator can get a list of cameras monitoring the terrorist in multiple perspectives and select the one required for the job.

Our approach is based on movement. Imagine you have many cameras in a closed network. In each camera you divide the field of view into a grid of cells. When movement is detected, a bounding box surrounding the object is generated. This bounding box is used to derive which cell is considered occupied at the current time. Our approach uses contradicting proof to find connectivity between cells. If one cell is occupied at a time and another cell is not occupied at the same time, then those two cells can surely not observe the same thing. If this is done over a significant time and there is enough movement across all cameras in the system, we can find cameras sharing the same field of view.

There is multiple uses cases our solution solves. One powerful use case is switching perspectives, another one is optimizing camera installation as each camera cost money to manufacture, install and maintain. If too many cameras observe the same thing, this is not optimal and waste resources. By also implementing tracking, that means following an object's path across multiple cameras, an operator can also follow that same object in other cameras field of view and thus maybe identify a terrorists face to alert the public.

Our prototype showed very promising results and shared field of view could be found very quickly as long as there is movement in each camera stream.