Improving Image stabilization in modern surveillance cameras

This thesis delves into enhancing image stabilization in Axis Communications surveillance cameras. We explore alternatives and extensions to the current image stabilization algorithm such as gyroscope-accelerometer sensor fusion stabilization and ways to combine image-based stabilization with gyroscope stabilization. Footage from surveillance cameras is stabilized using these techniques, evaluating them based on image quality and feasibility for real-time implementation on a modern surveillance camera. The results suggest that the existing gyroscope-based algorithm is hard to beat in a real-time environment. However, simple image-based techniques can complement gyro-based stabilization in the future with stronger hardware.

This thesis explores image stabilization, the process of mitigating unwanted camera motion effects in recorded videos. Most of us have probably experienced the unpleasantness of unstable video in recordings from our hand-held mobile phones. Here, stabilization is necessary to produce smooth, easily viewable videos. Similarly, good image stabilization is a crucial feature in modern surveillance cameras. Cameras can be mounted in elevated camera masts and susceptible to vibrations for example due to heavy wind in poor weather conditions. Without image stabilization, the video quality deteriorates, making surveillance impossible. At worst, this could happen during critical moments such as a break-in. To address this, Axis Communications has developed Axis EIS, an efficient stabilization algorithm that performs well in many cases. However, it faces challenges, particularly under high zoom settings common in mast-mounted cameras. The goal of this thesis is to investigate potential alternatives to the approach used in Axis EIS with the hope of covering these weaknesses, ensuring good stabilization and high quality video at all times.

The current stabilization algorithm relies on measurements from a gyroscope to do image stabilization. We compare this approach to stabilization algorithms combining the gyroscope measurements with measurements from an accelerometer, stabilization algorithms that use image analysis, and algorithms that combine gyroscope-based image stabilization with image analysis. The various algorithms are used to stabilize footage from a real surveillance camera and evaluated based on both the quality of the stabilization and the speed of the

algorithm. It is important that the stabilizer can run in real time in the limited hardware environment of a surveillance camera.

The results indicate that the pure gyroscope-based stabilization algorithm currently used provides decent qualitative stabilization at an incredibly low computational cost, making it hard to beat in this environment. However, simple image-based techniques when combined with the gyroscope-based stabilization algorithm improves the quality of the stabilization significantly. Unfortunately, this algorithm is barely to slow to run in real time. This might change in the future with stronger hardware and more optimized implementations.