Parallel Background Subtraction with KNN

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1. INTRODUCTION

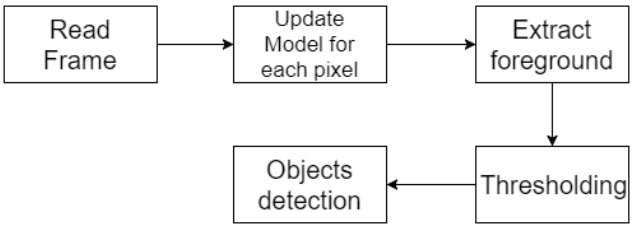
In computer vision, background subtraction is a commonly used approach for detecting moving objects in videos from static camera. The basic idea of the approach is that compute the difference between the current frame and background image generated by the algorithm to find out ROI (Region of Interest) for further processing. OpenCV (Open Source Computer Vision Library) provides methods such as GMG, MOG, MOG2 and KNN.

2. STATEMENT OF PROBLEM

The most commonly used background subtraction method in OpenCV is MOG2, provided with OpenCL and CUDA speedup support. KNN has better accuracy than MOG2 for complex dynamic scenes but speedup isn't provided by OpenCV currently. If KNN is used in surveillance system which emphasizes on real time moving objects detection, current performance can't reach 30fps which is normal standard for the camera. Our research targets to implement parallel techniques or hardware acceleration for KNN which is not provided in OpenCV.

3. PROPOSED APPROACHES.

The basic concept for MOG2 and KNN is use probability models to compute out the long-term distribution for value of each pixel formed by multiple frames of video. The following diagram are the common steps in both MOG2 and KNN and we will focus on parallelizing the second step because most time spent in it. Since there is no dependency for each pixel to compute its model so with this proper we consider it is possible to do operations in parallel. We will use some system tools to find out which operation is the bottle neck of whole compute progress and try to modify the algorithm or speedup with hardware acceleration.

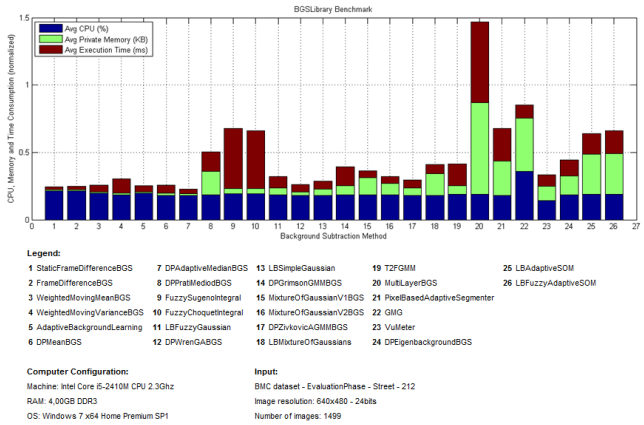


4. LANGUAGE SELECTION

We propose to use OpenMP because KNN is pixel by pixel computed and use OpenCL and CUDA to accelerate the complex mathematical calculations with hardware such as GPU.

5. RELATED WORK

In [3] compares 29 methods implemented in the [4] with BMC (Background Models Challenge) dataset, which has the originality to contain both synthetic and real sequences (more precisely, it is composed of 20 synthetic videos and 9 real videos). In this benchmark, a software (BMC Wizard) is employed to compute four quality measures.



6. STATEMENT OF EXPECTED RESULTS

We expect that our accelerated KNN will have even or better speed performance compared to MOG2 in which OpenCL is enabled and have positive correlation between speedup and CPU cores used.

7. TIMETABLE

November	December	January
Read related articles	Implement the system	Prepare for oral presentation

8. REFERENCES

[1] Zivkovic, Z., van der Heijden, F. 2006. *Efficient adaptive density estimation per image pixel for the task of background subtractio*n. In *Pattern Recognition Letters*, 27(7):773–780, 2006.

[2] Zivkovic, Z. 2004. *Improved Adaptive Gaussian Mixture Model for Background Subtraction*. *Proc.* In *Int'l Conf. Pattern Recognition*, vol. 2, pp. 28-31, 2004.

[3] Andrwes, S., Antoine V. 2014. *A comprehensive review of background subtraction algorithms evaluated with synthetic and real videos*. In *Computer Vision and Image Understanding*, May, 2014.

[4] Andrwes, S. *bgslibrary*. Github repository https://github.com/andrewssobral/bgslibrary