Proceedings of the 53rd Hawaii International Conference on System Sciences | 2020

Systems and Applications of Video Analytics

J. Pablo Muñoz
Intel Labs
pablo.munoz@intel.com

Fanny Nina Paravecino
Microsoft Corporation
fanny.nina@microsoft.com

1. Minitrack Introduction

Billions of devices produce and consume video every day at staggering rates. The demand for systems and applications that can efficiently analyze video at scale has not yet been met. Researchers and developers continue to explore myriad approaches for transcoding, processing, compressing, distributing and storing visual data, as well as the derived data produced as a result of applying different transformations to the original data. A few video analytics systems and applications have achieved great successes in the past few years, e.g., Scanner [1], but the field has plenty of opportunities for research and implementation. The resurgence of Deep Learning in recent years, in combination with traditional Image Processing (IP) and Computer Vision (CV) approaches, and the increasing availability of computational resources, from edge to the cloud, and sophisticated frameworks for processing visual data, e.g., Tensorflow [2], OpenCV [3], and Vlfeat [4], have made possible the development of video analytics systems and applications that attempt to meet the demands of consumers avid for extracting insights from visual data. These applications have successfully addressed a broad range of problems, including health care, retail, autonomous vehicles, prevention of infectious diseases, fashion, real-time assistive navigation [5], surveillance, and biometric authentication.

This minitrack is open to researchers and practitioners that design and/or implement novel systems and applications that incorporate:

- Real-time video analytics and/or offline video processing
- Intelligent management and storage of visual data

2. Overview of papers

Gutierrez et al. present *Vega: A Computer Vision Processing Enhancement Framework with Graph-based Acceleration*. Vega allows for the efficient implementation of computer vision and image processing pipelines in computing devices at the edge. Users can easily create Computer Vision pipelines by taking advantage of Vega's interface. The framework exploits the fact that CV algorithms are composed of many stages. Thus, pipelines are described as a graph in which each node represents a stage of the pipeline. Vega dynamically schedules each independent stage in the pipeline on multi-core CPU, and improves thread communication by using an efficient shared memory model.

Gutierrez et al. evaluate the framework using popular Computer Vision workloads, e.g., Face Detection. They also demonstrate how models can be efficiently loaded in the initialization phase of the pipeline, allowing the reuse of preloaded weights during inference in the execution phase. Vega improves the performance of the algorithms used for evaluation up to 4.82x, and produces better hardware utilization. Several research opportunities for future work will be discussed during the paper's presentation.

References

[1] A. Poms, W. Crichton, P. Hanrahan, and K. Fatahalian, "Scanner: Efficient video analysis at scale," *ACM Trans. Graph.*, vol. 37, pp. 138:1–138:13, July 2018.

[2] M. Abadi, P. Barham, J. Chen, Z. Chen, A. Davis, J. Dean, M. Devin, S. Ghemawat, G. Irving, M. Isard, M. Kudlur, J. Levenberg, R. Monga, S. Moore, D. G. Murray, B. Steiner, P. Tucker, V. Vasudevan, P. Warden, M. Wicke, Y. Yu, X. Zheng, G. Brain, I. Osdi, P. Barham, J. Chen, Z. Chen, A. Davis, J. Dean, M. Devin, S. Ghemawat, G. Irving, M. Isard, M. Kudlur, J. Levenberg, R. Monga, S. Moore, D. G. Murray, B. Steiner, P. Tucker, V. Vasudevan, P. Warden, M. Wicke, Y. Yu, X. Zheng, and Others, "TensorFlow: A System for Large-Scale Machine Learning.," in *OSDI*, vol. 16, pp. 265–283, 2016.

[3] G. Bradski, "The OpenCV Library," *Dr. Dobb's Journal of Software Tools*, 2000.

[4] A. Vedaldi and B. Fulkerson, "Vlfeat: An open and portable library of computer vision algorithms," in *Proceedings of the 18th ACM International Conference*

URI: https://hdl.handle.net/10125/64559
978-0-9981331-3-3

on Multimedia, MM '10, (New York, NY, USA), pp. 1469–1472, ACM, 2010.

[5] J. P. Muñoz, B. Li, X. Rong, J. Xiao, Y. Tian, and A. Arditi, "An Assistive Indoor Navigation System for the Visually Impaired in Multi-Floor Environments," in *7th Annual IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems (IEEE-CYBER 2017)*, 2017.