



# VIDENTIFIER<sup>TM</sup> FORENSIC

## GPU ACCELERATED LOCAL IMAGE DESCRIPTORS IN VIDENTIFIER FORENSIC

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We present a high-speed GPGPU-based method to extract local image descriptors. The local descriptor scheme are the Eff<sup>2</sup> descriptors, a variant of SIFT. The descriptors are used to feed the NV-Tree high-capacity high-speed multidimensional index for faster-than-realtime video identification, in conjunction with other large-scale descriptor-processing methods, such as a scene-based representative-descriptor filter.

NVIDIA CUDA was used to implement a high-speed local image descriptor extraction process. The Eff<sup>2</sup> descriptor scheme is tuned for differentiation and efficiency in large-scale retrieval – index size is billions of 72-dimensional local descriptors.

CUDA was used as it is reasonably straightforward to program for, and its flexible computation model fits well to descriptor extraction, which is in some cases not trivial to parallelize.

We have gone from 10 FPS on x86 to 80FPS on a CUDA GPU. Furthermore, a GPU-based solution is easy to deploy and manage, and is cost-efficient compared to a cluster – especially when latency is taken into account.

The descriptor scheme was further modified from previous Eff<sup>2</sup> descriptors by adding mirror invariance by way of comparison of two strongest angles and normalizing descriptor polarity.

This fast GPU implementation of “vanilla” descriptors will now serve in further theoretical research and expansion of descriptor invariance, robustness, and description capabilities.

A high-speed extraction process and large scale index allow for interesting descriptor processing, such as a scene-based representative-descriptor set selection filter. Expensive to compute, made cheaper with GPU acceleration, the filter cuts database volume by over 90% (Work by Lejsek et al).

Scene-based descriptor reference sets are indexed, approximate nearest neighbor descriptors for query streams obtained, in NV-Tree data structure. (Lejsek et al.).