GPGPU, 8th Meeting

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Agenda

- 6th meeting
- 7th meeting
- Future meetings
- Activities

6th meeting

- jCUDA – library for accelerating Java applications
- Presenting various library functionalities
- Examples
- Questions

7th meeting

- Applications and ideas for problems that can be solved using the GPU
  - Classification
  - Medical imaging
  - Image compression
  - Robotics
- Presented by Dr. Boaz Ben-Moshe, Ariel University Center

Future meetings

- Hoopoe – GPU cloud solution and architecture
- Building a GPU cluster – a recipe
- OpenCL standard
- More advanced topics
- Looking for ideas ☺

Activities

- Basis for a platform to exchange knowledge, ideas and information
- Cooperation and collaborations between parties in the Israeli industry
- Representing parties against commercial and international companies
- Training, courses and meetings with leading companies

NVPP
NVIDIA **P**erformance **P**rimitives

Agenda

- Introduction to NVPP
- Target audience & users
- Features
- Known limitations
- Future work
- Examples

Introduction to NVPP

- Software library providing access to image processing functions (OpenCV +)
- Based on CUDA
- Works on NVIDIA hardware
- Following Intel IPP, but with focused on image/video functions
- API based on C

Target audience

- Developers & researchers looking to accelerate image & video processing
- Former background with IPP is not required (but always an advantage)

Features

- Covers most common operators (Add, Sub, Mul etc.)
- Supports relevant data types
- Image channels from 1 to 4 per pixel
- Library is self contained (no need for further integration)

Data-types support

- For per pixel and per channel:
  - 8 bit Integer (Un/Signed → Byte)
  - 16 bit Integer (Un/Signed → Short)
  - 32 bit Integer (Un/Signed → Int)
  - 32 bit float
  - 64 bit double

Provided functions

- Divided into 3 main categories:
  1. **Core** – general & memory management
  2. **“OpenCV”** – operators, morphology
  3. **Image processing** – advanced image functions (JPEG compression…)

Core functions

- Library versions
- Underlying hardware details
- Image operations:
  - Allocate (based on image characteristics)
  - Free
  - Set
  - Copy

“OpenCV” functions

- Bit-depth conversion
- Copy with border
- Transpose
- Swap
- Operators:
  - Add
  - Sub
  - Mul
  - Div
- AbsDiff
- Threshold
- Compare
- Mean StdDev
- NormDiff
- Filters:
  - Linear
  - Dilate
  - Erode
  - Mask
- Mask sum
- Max/Median/Min
- Sum
- Resize
- Rotate
- Mirror
- Warping

Image processing

- JPEG DCT, Quantization
- Level Shift
- Color conversion (YUV / RGB)
- Haar
- Canny edges
- Histograms
- LUT

Known limitations

- Functions support 8-bit, 16-bit integers or 32-bit float
- Image dimensions are sometimes limited to 8k x 8k in size

Future work

- Supporting more data types
- Extending set of implemented algorithms
- Looking for your requests and needs!

Examples

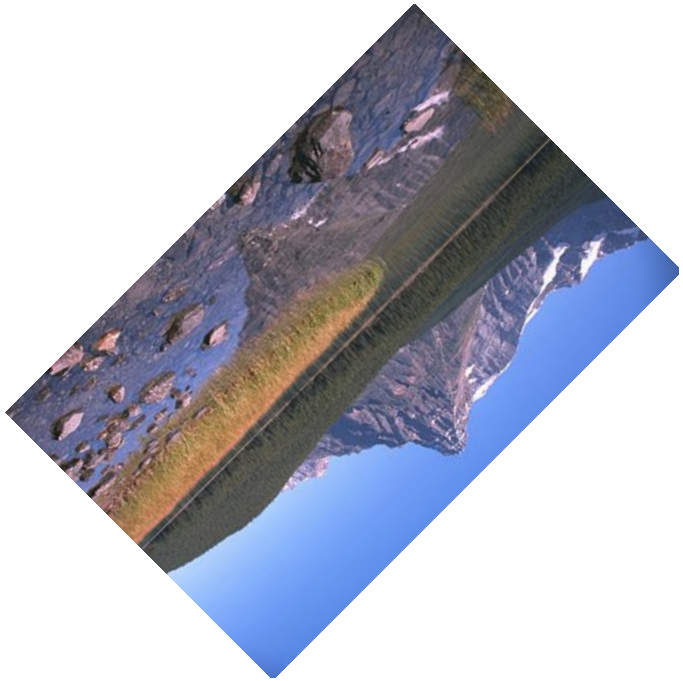
- Image transforms:
  - Resize
  - Rotate
  - Transpose
- Histogram

Resize

- Source image: 512 x 512 (32 bit)
- Destination image: 1024 x 768 (32 bit)

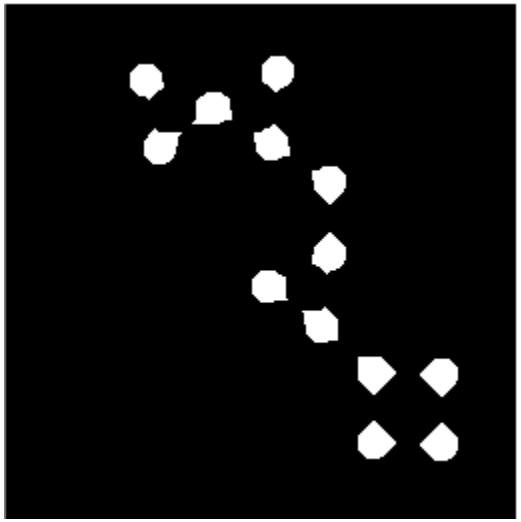
Rotate

- Source image: 512 x 512 (32 bit)
- Angle: 90°, 135°

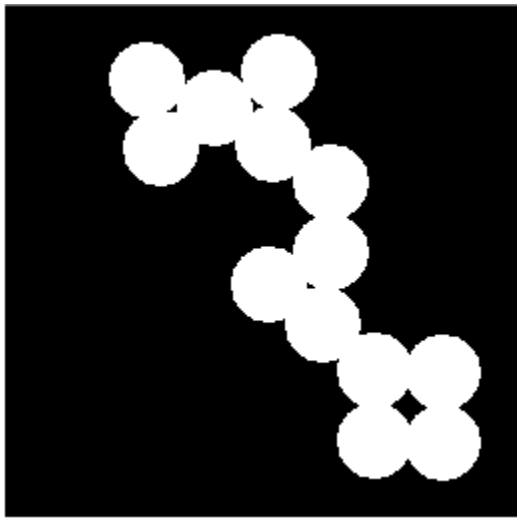


Erode

Before

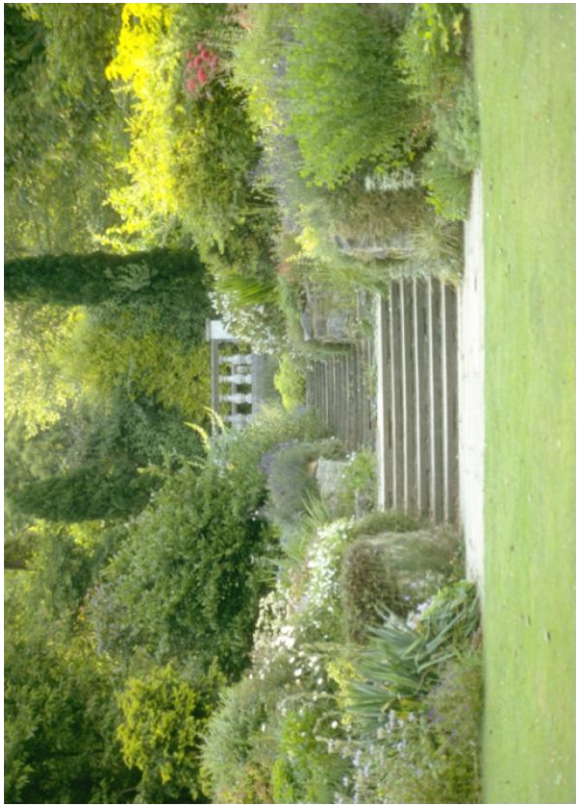


After

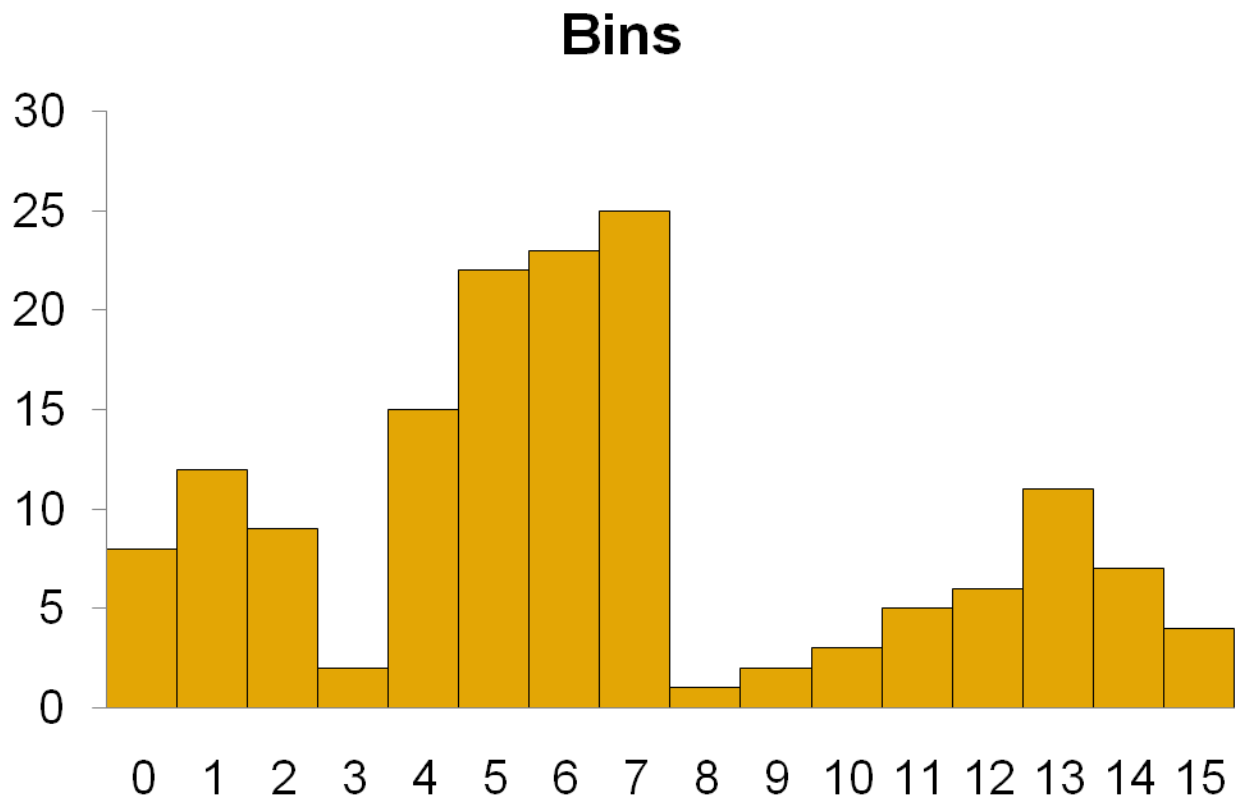


Transpose

- Source image: 512 x 512 (32 bit)



Histogram



Summary

- NVPP provides a fair amount of algorithms for image / video processing on the GPU
- Performance improvements depend on correct usage
- High potential for integrating into existing infrastructures
- Straight-forward API
- Can integrate with graphics API! (OpenGL/ DX)

Questions