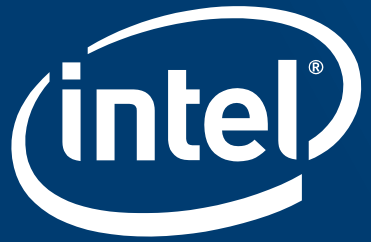

Vehicle surround view in Libxcam

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- Libxcam Introduction
- Vehicle Surround View Introduction
- Surround View in Libxcam
- Quality and Performance

libxcam Introduction

libxcam is an opensource project and focus on image quality improvement and video analysis. It makes GPU/CPU working together to improve quality and performance. OpenCL is used for video acceleration and easy to run on different platforms. All features are tested in Baytrail, Braswell Apollolake and SkyLake.

Project repo on github: https://github.com/intel/libxcam

libxcam Features

Noise Reduction

HDR/WDR

Digital Video Stabilization

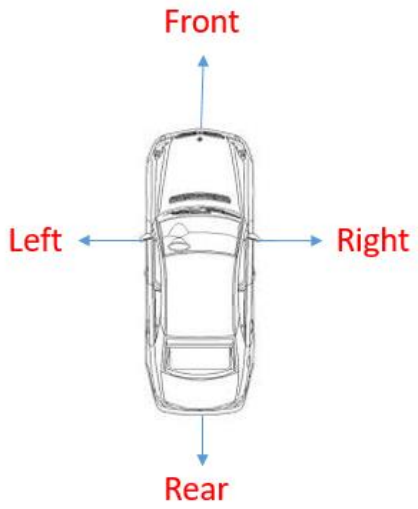
Surround View

.etc

Vehicle Surround View Introduction

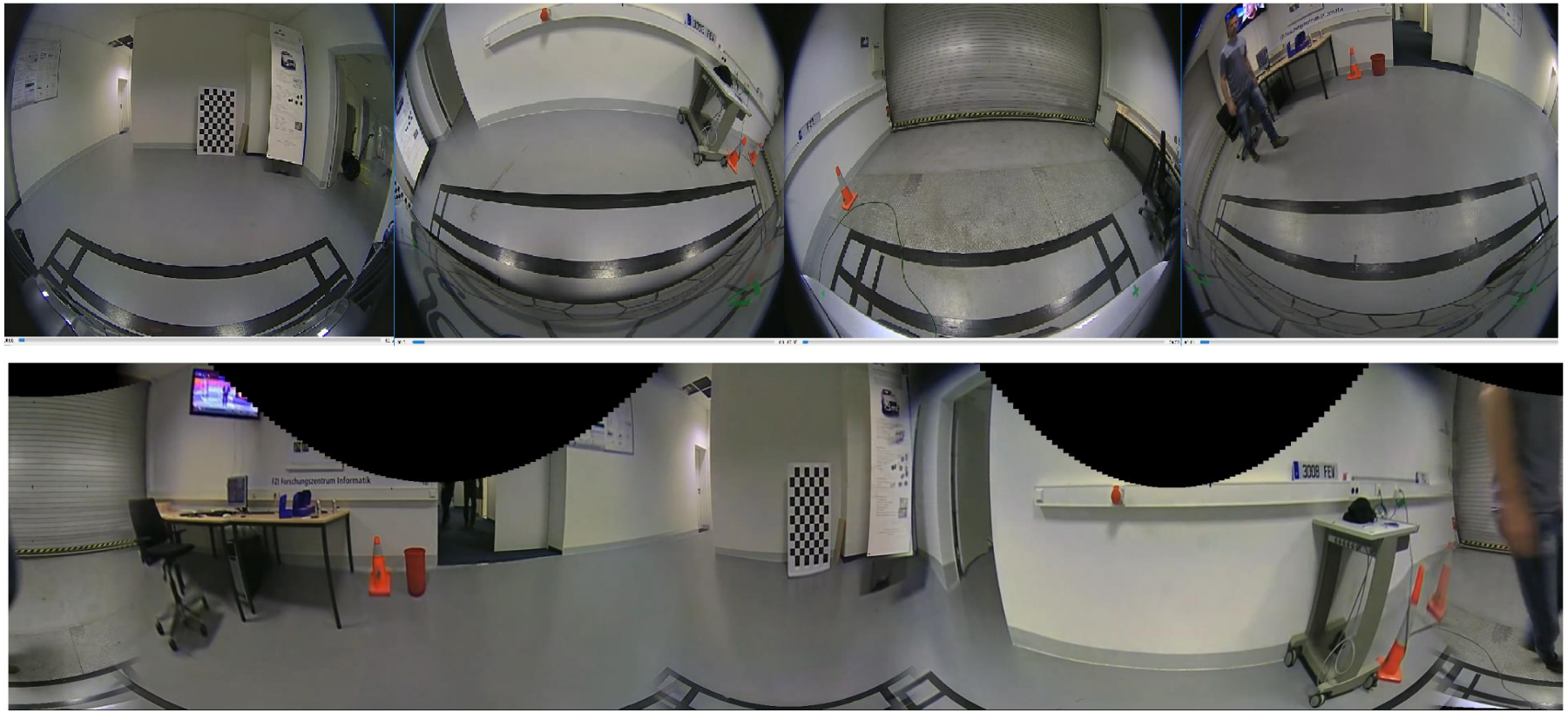
Vehicle surround view, view of scenes surround the vehicle, is one of the key features in Advanced Driver Assistance Systems (ADAS).

Several cameras (usually four, maybe more) are equipped around the car to capture the scenes outside.



Vehicle Surround View Introduction

The key algorithm is to generate a scene contains all the surrounded information by utilizing the scenes captured by all the cameras.



Vehicle Surround View Introduction

Similar as panorama generation, but much more complex and difficult.

Due to distant locations of adjacent cameras, the content of overlap area of adjacent images may be quite different.

Traditional solutions

Point Selection: For each pixel in final generated surround view image, calculate its corresponding position on particular image and select the pixel in that position as the result.

Blend directly: Apply image blending algorithm directly on overlap area of adjacent images.

Traditional solutions

Drawback: Both methods can easily generate ghost or double vision effect.

Surround View in Libxcam

Apply image stitching algorithm on overlap area of adjacent images before the blending process to reduce ghost or double vision effect as much as possible.

An optimized auto-scaling stitching algorithm based on feature match results of the overlap area of adjacent images is designed.

Use bowl-view model as the projection plane for the final stitched image.

Bowl View Model

Normal 2D image is generated by projecting scenes captured by the camera on a 2D image plane.

Surround view image is generated by projecting scenes surround the vehicle on a 3D plane with its shape like a “bowl”.

The vehicle is on the center of the “bowl”.

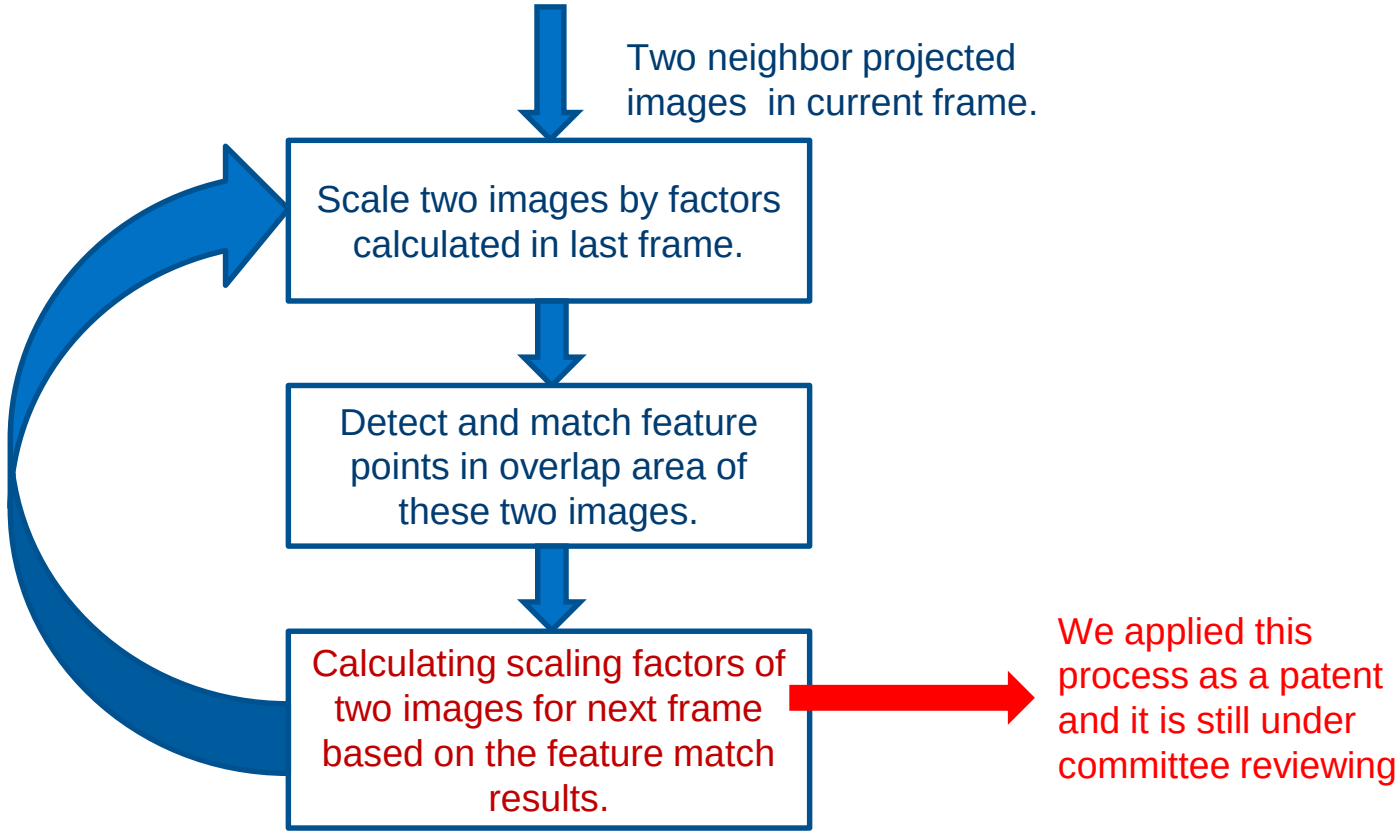
Bowl View in Libxcam

A 3D ellipsoid curve plane is used in Libxcam to simulate the bowl model.

Each image captured by each camera is projected on the 3D ellipsoid curve plane we defined.

Image stitching algorithm is applied on the projected images.

Image stitching process in Libxcam



Quality Comparison

We choose two sets of data (both indoor and outdoor) to compare the results of our solution with traditional method.

For better visual effect, we only extract the overlap area of input images and show the results comparison.

Quality Comparison (indoor 1)

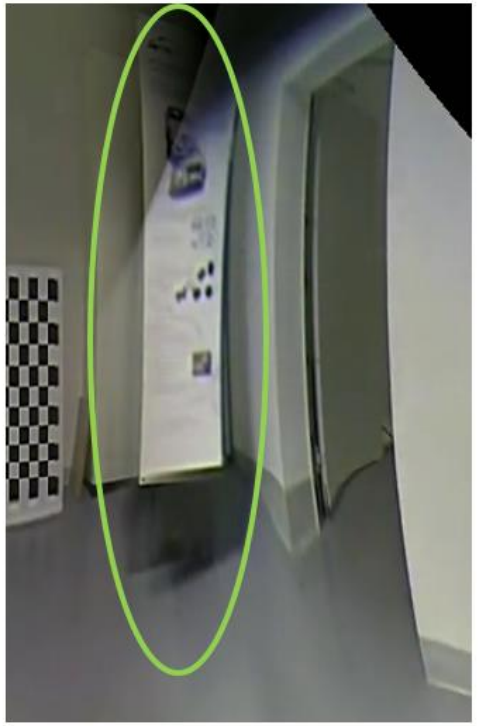
Input:

Front Cam

Right Cam

Output:

Traditional solution

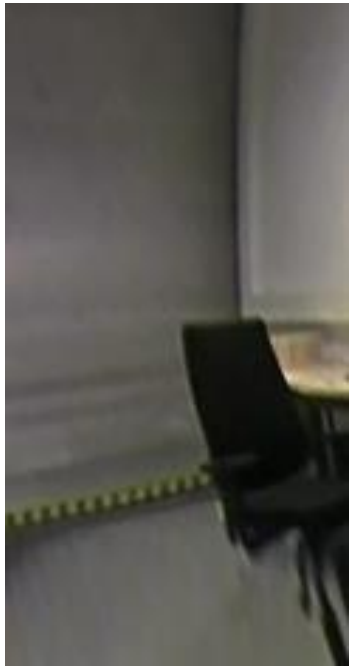


Our solution

Quality Comparison (indoor 2)

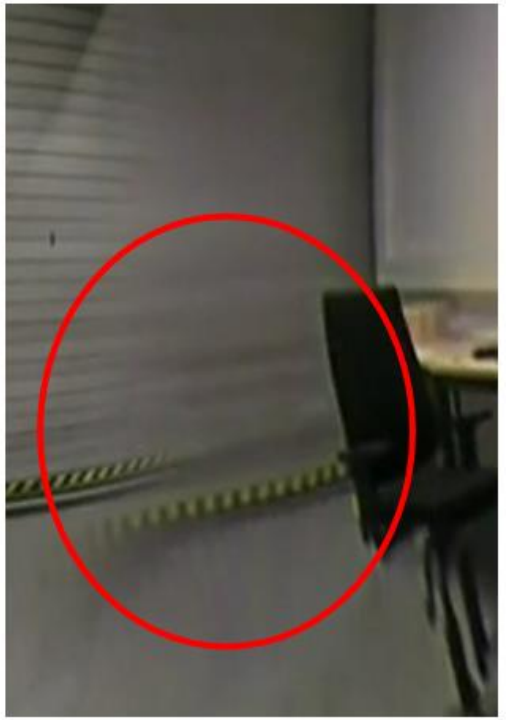
Input:

Rear Cam

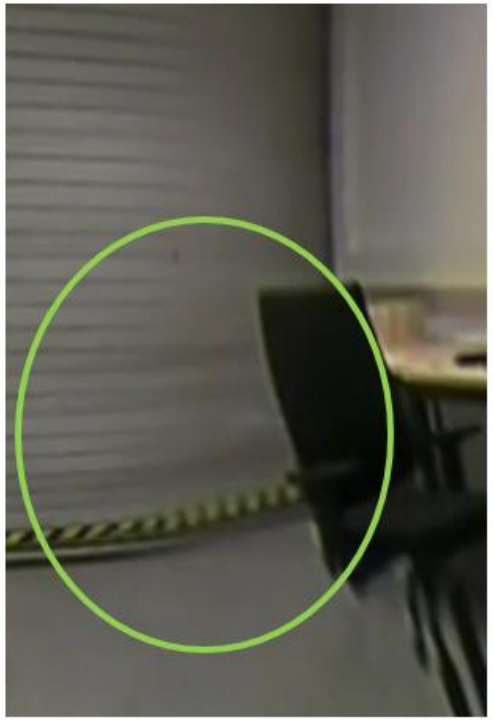


Left Cam

Output:



Traditional solution



Our solution

Quality Comparison (outdoor 1)

Input:

Front Cam

Left Cam

Output:

Traditional solution

Our solution

Quality Comparison (outdoor 2)

Input:

Rear Cam

Left Cam

Output:

Traditional solution

Our solution

Performance

Machine: Intel(R) Core(TM) i7-6770HQ CPU @ 2.60GHz
CPU cores : 4
Processors : 8

Input resolution: 1280x720x4 (number of cameras)
Output resolution: 1920x1080

Surround view performance: 81.9fps

Project Info & Contact

Project wiki page: *https://github.com/intel/libxcam/wiki*

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