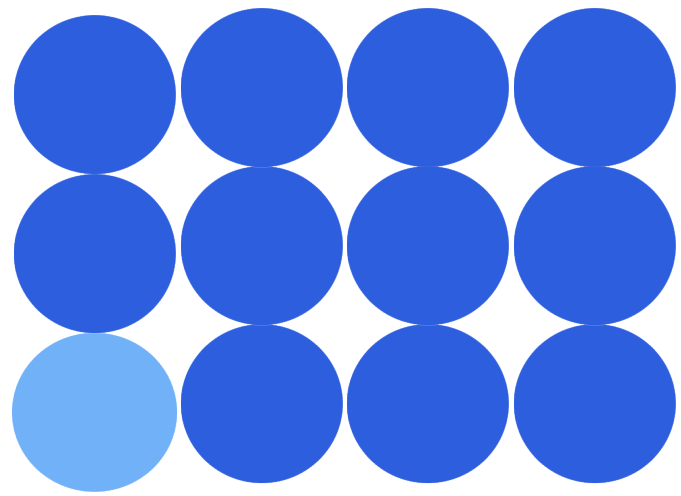


Optical Flow Datasheet



The optical flow field is used to estimate the 2D motion projected on the image plane by the objects moving in the 3D scene.

Optical Flow Implementation

The Optical Flow implementation will be based on a block matching method using horizontal and vertical projections of the blocks. This projection approach is chosen because it minimizes the requirements of FPGA resources. Furthermore, it has been found that the use of projection effectively nullifies certain types of pattern noise, yielding improved performance over the direct methods.

DDC's Tracker

The optical flow can be illustrated with vectors that show motion that exists from a reference frame to another frame. Figure 1 below illustrates motion vectors. The camera in this picture is mounted on a car that is traveling on the right side of the road. The vectors illustrate the optical flow of the oncoming car.

FPGA Resource Requirements

Slices	FFs	LUTs	BRAM	Mults	DSP 18x18
3492	9255	8148	33	8	6

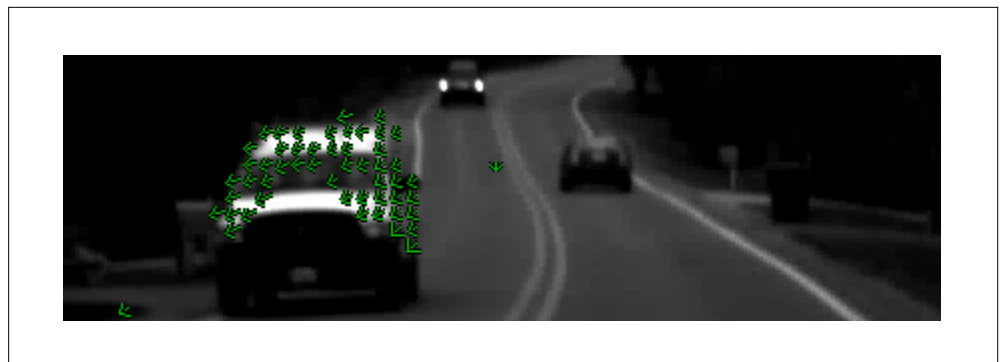
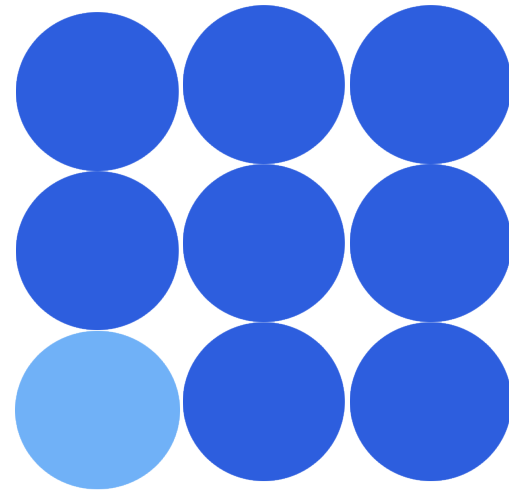
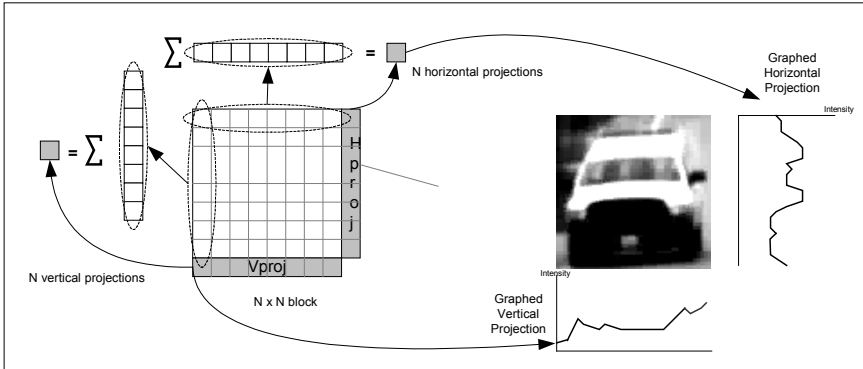


Figure 1 Optical Flow Motion Vectors

The horizontal and vertical projections are a summation of the intensities across the block rows and columns respectively. The projections will give a signature to a given block as shown in Figure 2 below.



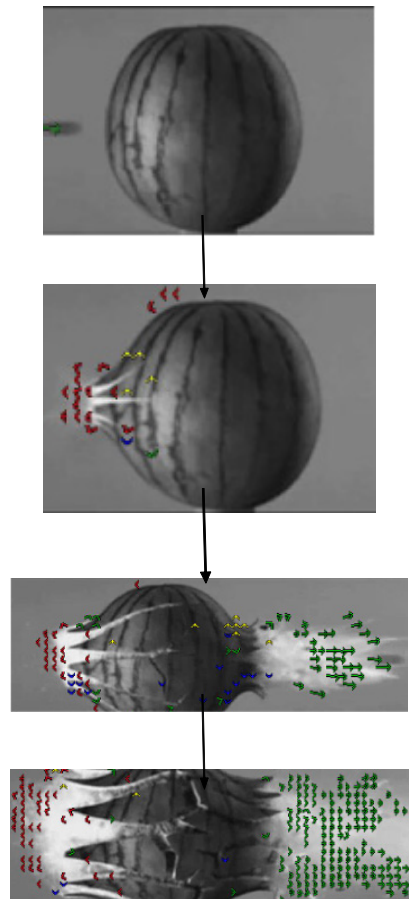
Optical Flow Applications

The DDC Optical Flow can be used in many applications from tracking in Automotive applications to explosion detection... Modeling has indicated that an 8x8 block is a good size for the projection calculation. This seems to give sufficient information to distinguish blocks and present a dense optical flow.

Before projections are calculated, the image data needs to be conditioned. As with any type of optical flow approach, if too much noise is present or not enough detail is present within the area of interest, a given vector may not be accurately determinable; therefore techniques are required to aid in the decision process of calculating or displaying a vector. For noise reduction, experimentation has shown some improvement with using a Gaussian 5x5 kernel. For detail detection, a modified Sobel mask and thresholding is used to determine if edges exist.

Representation of the optical flow vectors is thru the use of overlays upon the original image. The figure below illustrates a 2-color optical flow vector overlay. The green vectors represent vectors calculated based on movement from the previous image. The yellow vectors represent vectors that were also present from a previous frame of vectors.

Examples



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