Calculating Optical Flow using FPGAs

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Outline

- What is Optical Flow?
  - Quick example
- What are FPGAs?
- Why use FPGAs to calculate Optical Flow?
- What part am I working on?
  - Project time line

Optical Flow

- Input: Sequence of images
  - From camera, movie, etc.
- Output: Vector field of motion at each pixel
- Information extracted:
  - Motion of objects in the visual scene
  - Motion of the camera

01/20

Image sequence from the Vision and Autonomous Systems Center's Image Database
http://vasc.ri.cmu.edu//idb/html/motion/cil/index.html

02/20

Image sequence from the Vision and Autonomous Systems Center's Image Database
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03/20

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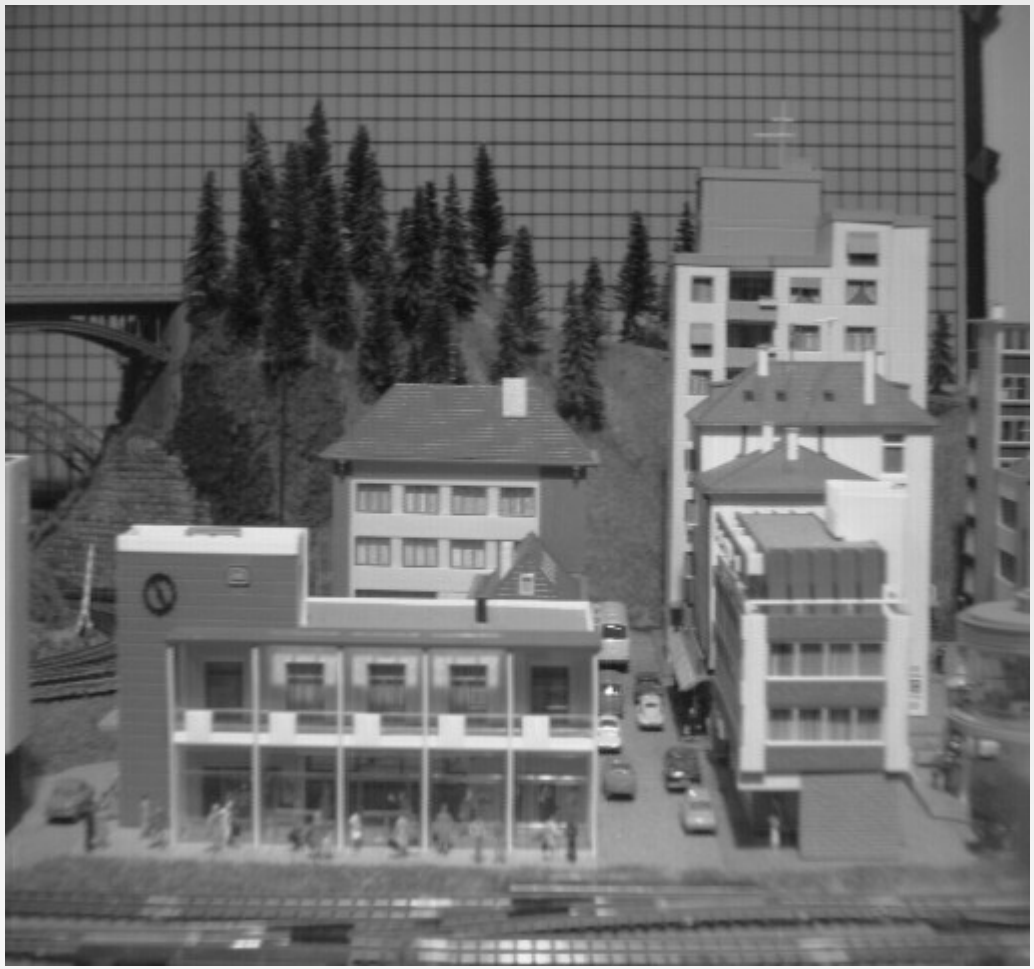

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20/20

Image sequence from the Vision and Autonomous Systems Center's Image Database
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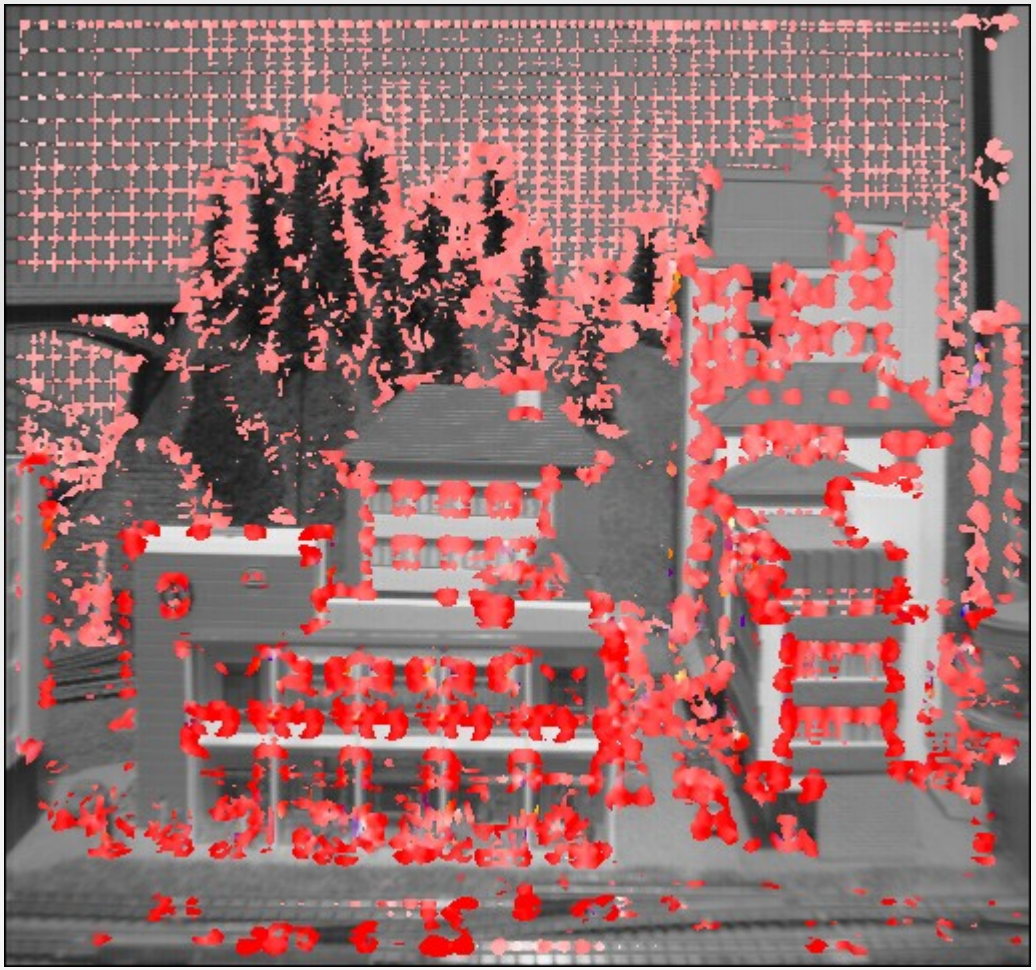
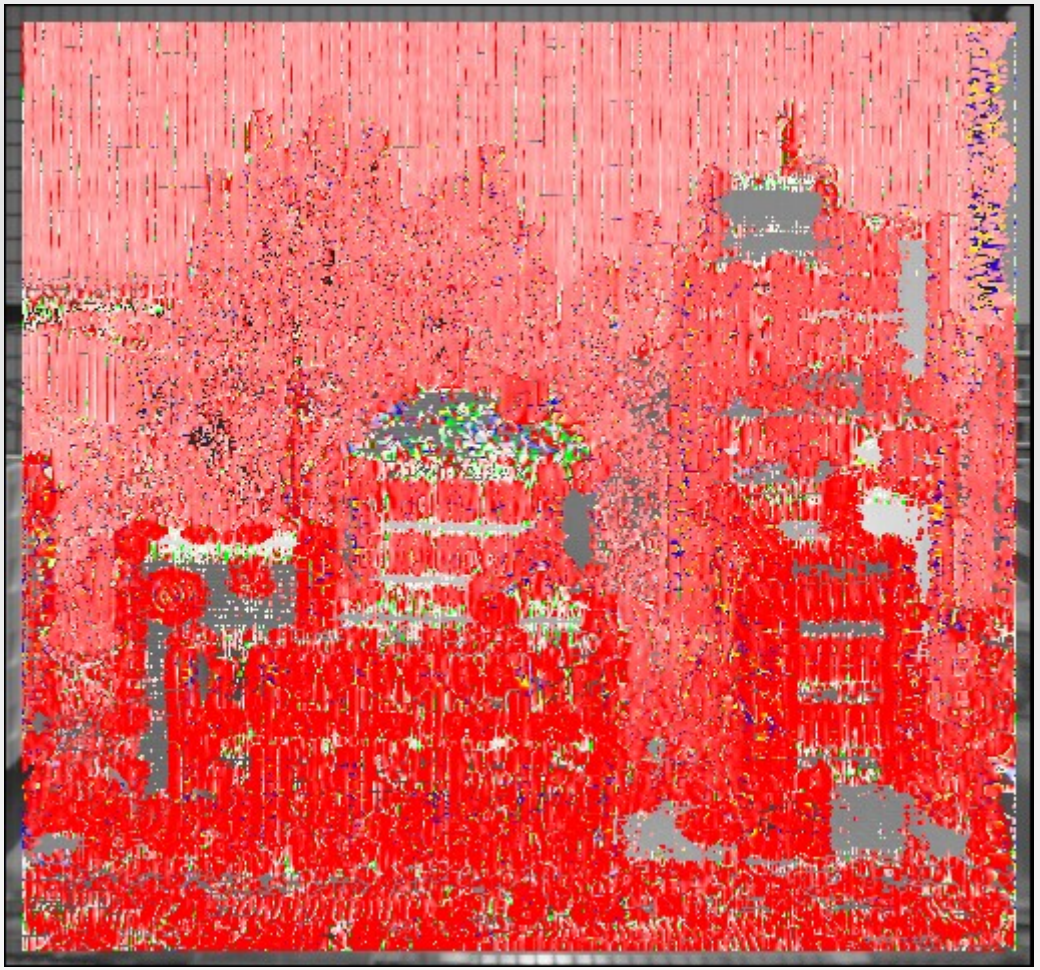
Flow Field – Lucas & Kanade



Flow field calculated using FlowJ, written by M. D. Abramoff, W. J. Niessen and M. A. Viergever

Flow Field – Uras et al.



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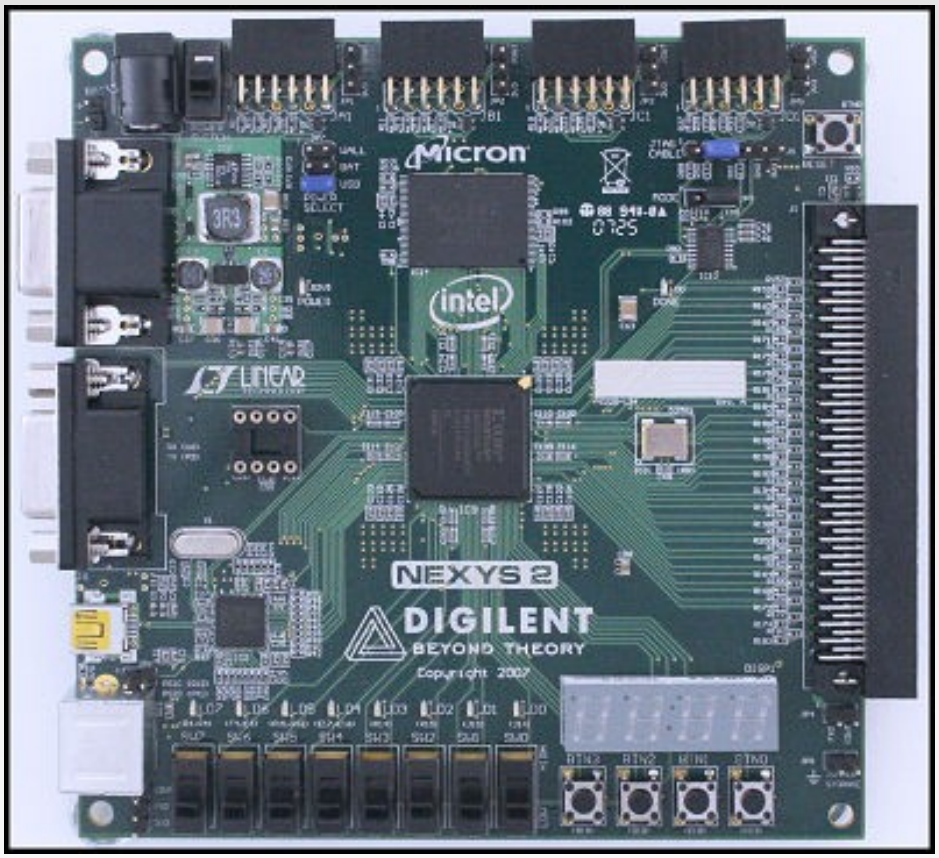
Field Programmable Gate Arrays

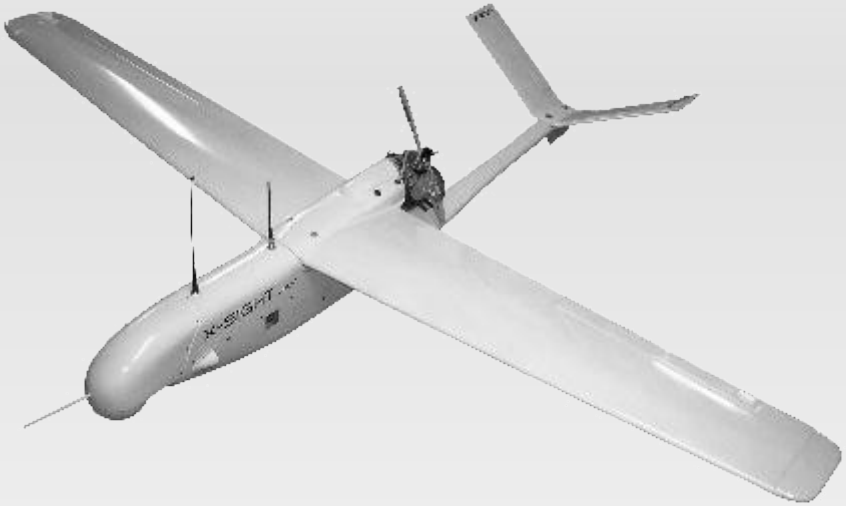
"FPGAs"

- Reprogrammable digital logic
- 100 000s of logic gates all on one chip
- Implement algorithms in hardware:
  - cryptography
  - speech recognition
  - video processing
  - many more



Motivation

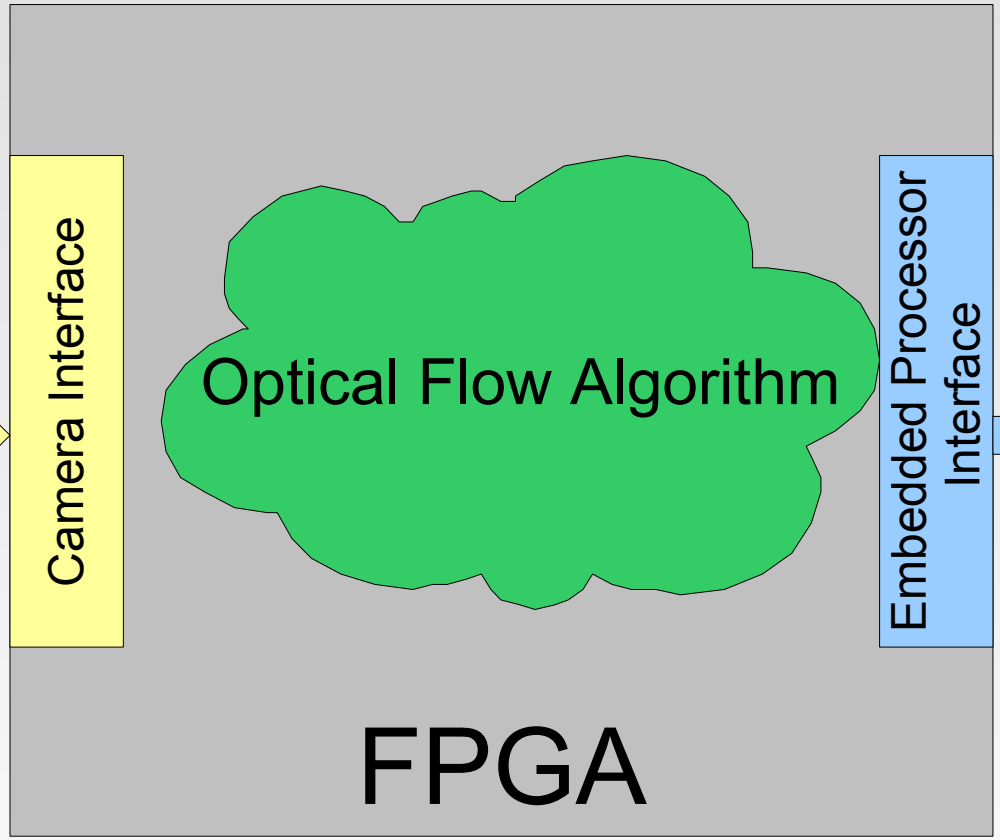
- Calculate optical flow without a PC
- FPGAs:
  - are smaller and lighter
  - use far less power
- Use in embedded devices



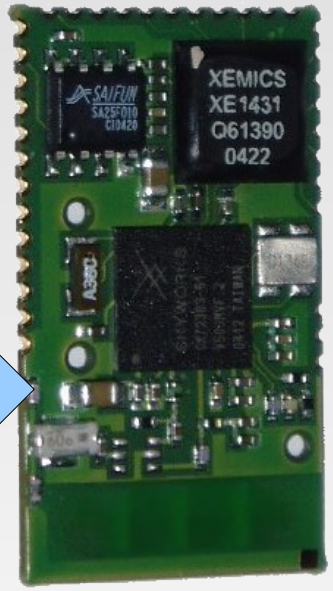
Processing Chain

Camera

Sees the world



Performs the heavy calculations



Embedded Processor

Makes the decisions

Time Line

Weeks 1-3	Background research into various optical flow algorithms Requirements specification
Week 4	This presentation Learn a language used to program FPGAs
Weeks 5-7	Write literature review draft Begin design implementation
Mid-semester Break	Write final copy of literature review Further implementation
Weeks 8-11	Refine implementation Test various optimisations
Week 9	Write outline of final report
Weeks 12-13	Finalise design and results Write draft report
Week 13	Final presentation
Week 14	Finish and submit report

Questions?