

Method and Apparatus for Visual Motion Recognition

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American patent application 19/09/2003

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no. 10/251,208

Description:

This patent applies to a new **computational architecture** for visual motion processing expressed as networks of analog processing units (see illustrations) that is inspired by current knowledge of **cortical processing**. The patent is based on an **optical flow network** that performs distributed and parallel processors at each image location, so estimating local optical flow. A **motion selective network** is superimposed on the optical flow network. This network automatically identifies objects that fall into a pre-defined class of preferred motions (e.g. ‚left-ward’ motion) and that have a particular object size. The output of the motion selective network thereby dynamically reconfigures the relationship between units in the optical flow network, suppressing the response of unrelated units, and thereby improving the estimate of optical flow.

An **attentional network** can be superimposed on motion selection. In its passive mode of operation, the attention simply reports the center position of any object that matches the given motion characteristics. If actively driven, this network controls the focus of **visual attention**, actively selecting and enhancing the region where visual motion should be estimated.

Sensor Technology:

The relevance of this architecture is: firstly, that it permits active extraction of moving objects very close to source image data reducing the need for additional general purpose computation. Secondly, that the highly complex visual processing system is implemented in a single focal-plane aVLSI BiCMOS sensor. Results of a first prototype are shown in appendix.

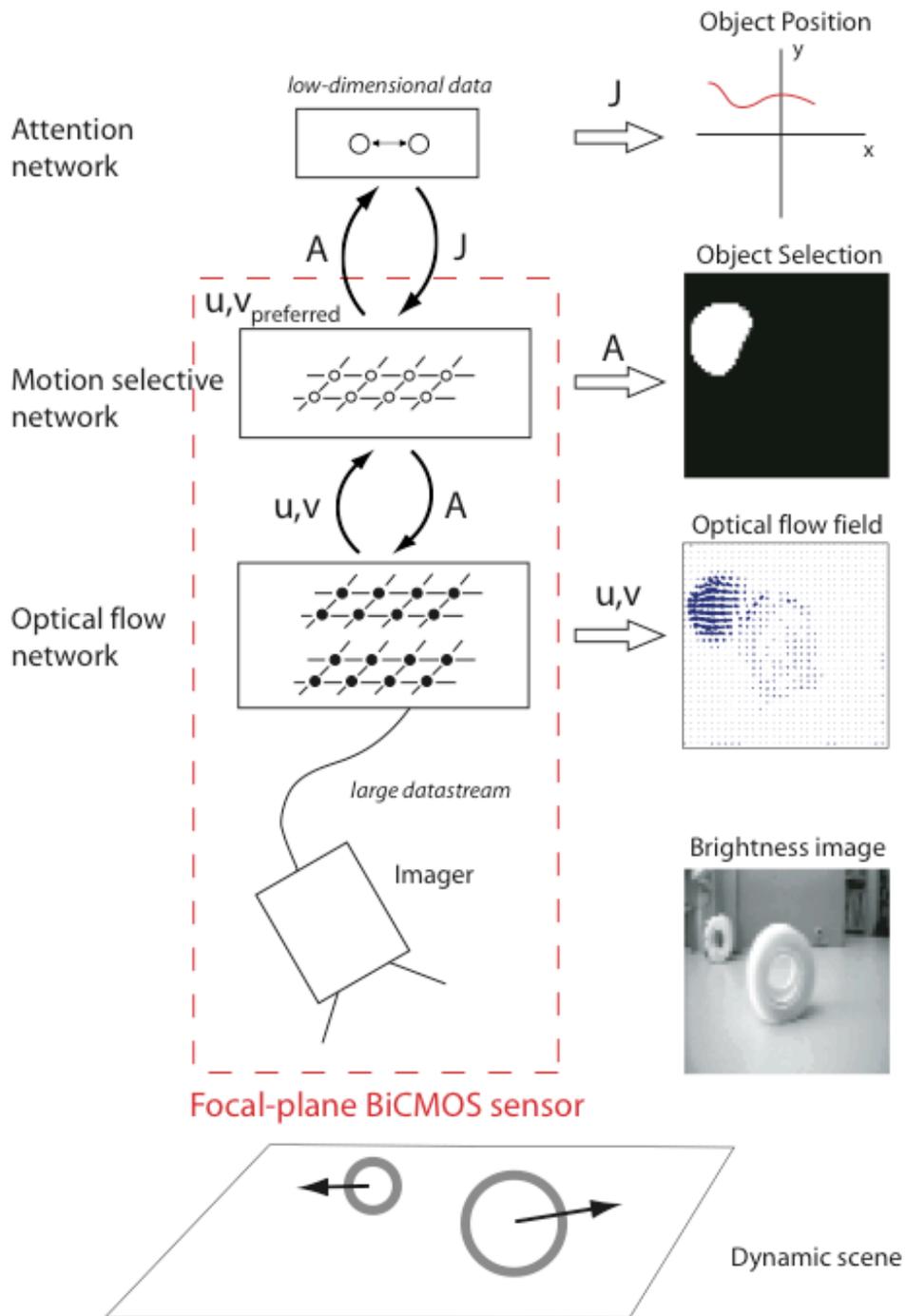
Advantages:

- **Cheap**. In large quantities such focal-plane BiCMOS sensors can be as little as ~2\$/piece.
- **Very Fast**. Due to the analog nature of the computation.
- **Very low power**. Due to analog, mainly subthreshold operation of circuits.
- **Very low bandwidth**. Output (e.g. object position). Allows simple post-processing, yet intelligent system architectures.

Applications:

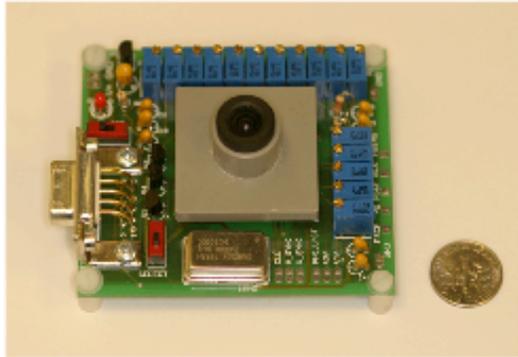
- Robotics. Also intelligent toys and edutainment applications etc.
- Surveillance systems of any kind. Low costs allow the application of sensory arrays.
- Intelligent buildings.

System architecture:

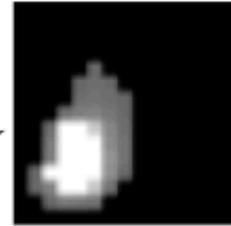


Prototype system:

complete board with sensor



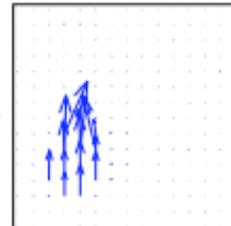
real-time sensor output



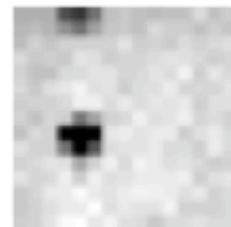
object selection



activation state of
single processors

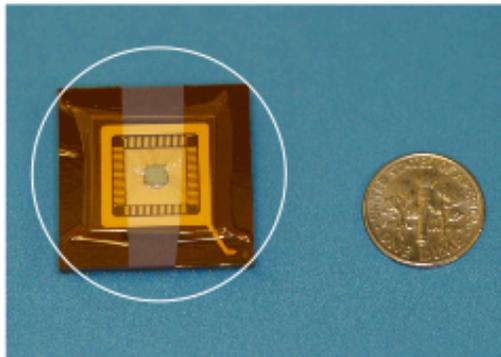


optical flow output



photoreceptor signal

prototype sensor - 15x15 processor array



standard PGA84 package

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