Seeing like a Cephalopod: Colour Vision with a Monochrome Event Camera

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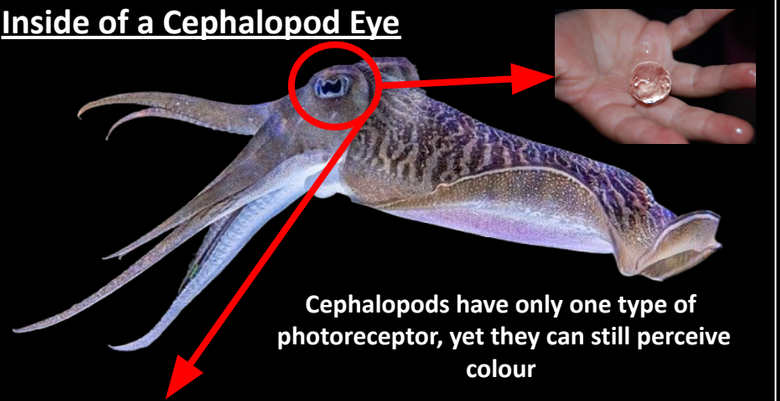
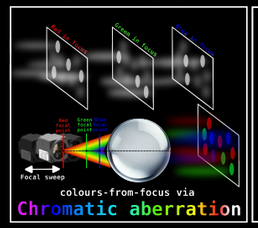
Inside of a Cephalopod Eye



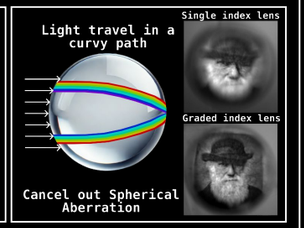
Cephalopods have only one type of photoreceptor, yet they can still perceive colour

Ball lens



Adaptive Pupil shape

Graded Refractive Index



About this work:

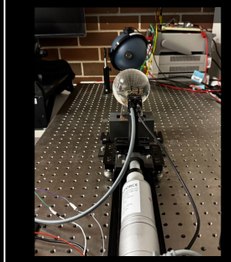
Event Camera + Ball lens = Hyperspectral Event-based Sensor

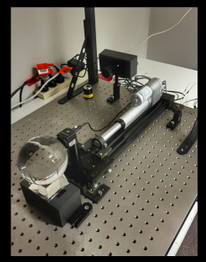
- Event camera provides sparse, high temporal resolution data
- Ball lens provides chromatic aberration
- "colours-by-focus" is enabled by shifting the focal distance

Contributions:

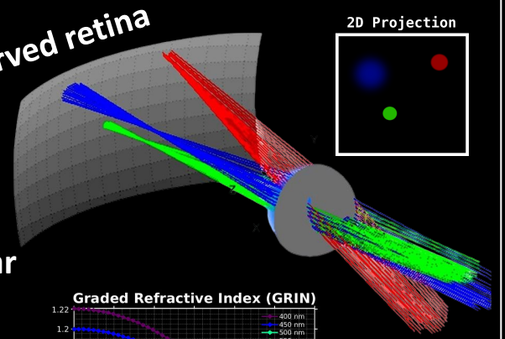
- A demonstration of a cephalopod-inspired imaging technique that enables an event camera to perceive spectral information in visible light and near-infrared
- Develop a computational simulator to assess the contribution of chromatic aberration for colour perception

Optical Setup

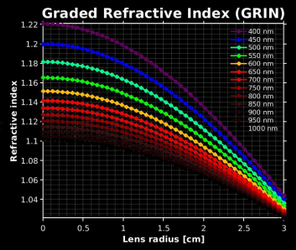




Simulation framework



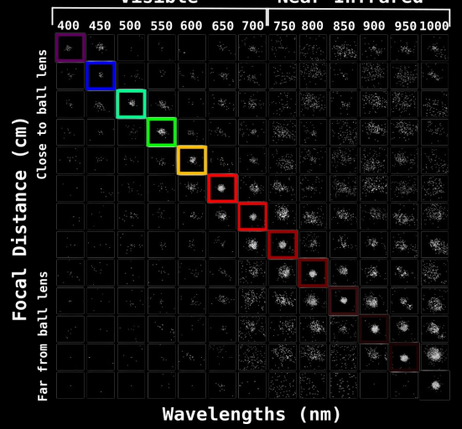
Irregular pupil

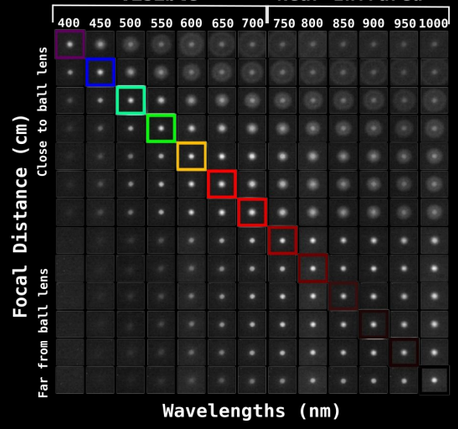


Paper

Event-based and Frame-based Hyperspectral Sensing and Imaging:

Measuring Visible and Near Infrared





Cephalopod-inspired "colours-by-focus" Processing