

# Garibaldi Pineda García

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## neuroSLAM

*Solving the simultaneous  
localization and mapping problem  
with spiking neural networks*

# Where's Wally?



## Simultaneous Localization and Mapping

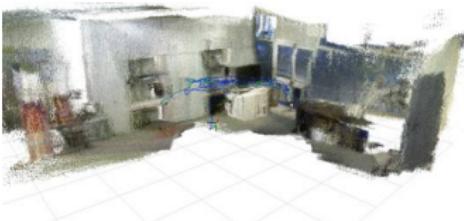
Navigation,



augmented  
reality,



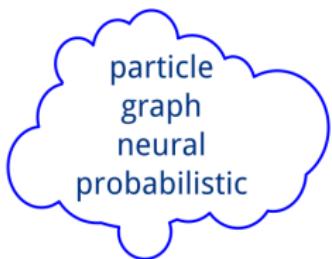
environment  
reconstruction



## Simultaneous Localization and Mapping



Get



Fit



Update



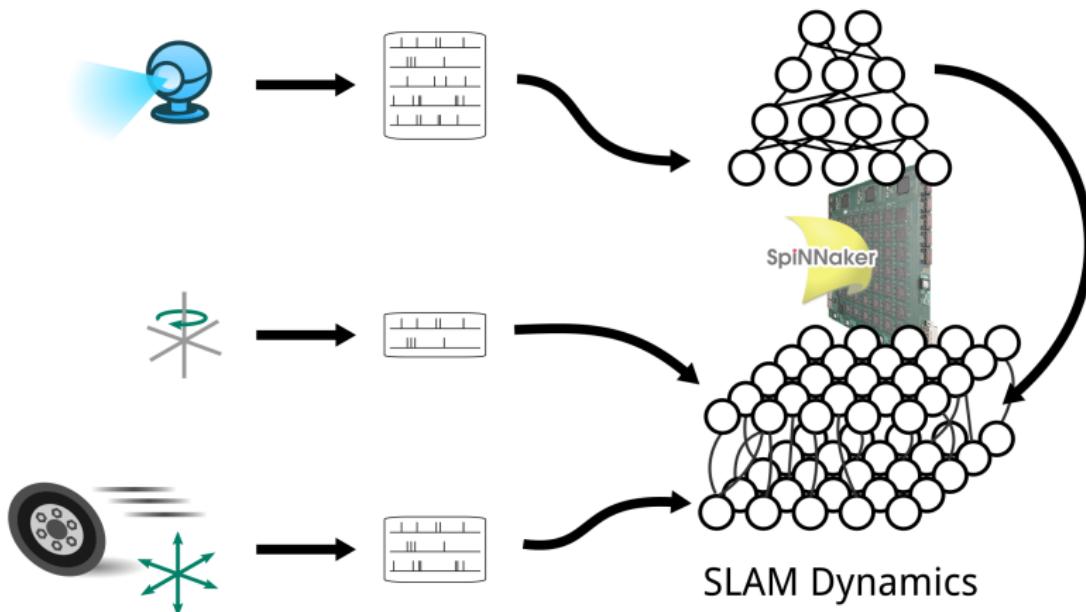
- Power hungry
- Exotic sensors
- Either indoor or outdoor



- Neural networks SLAM[1]
- More efficient
- Neuromorphic hardware

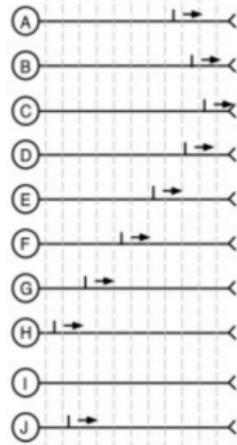
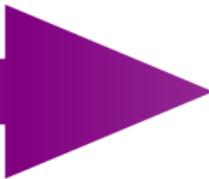


What features?  
Which room?



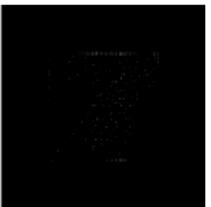


How to get spiking visual input?

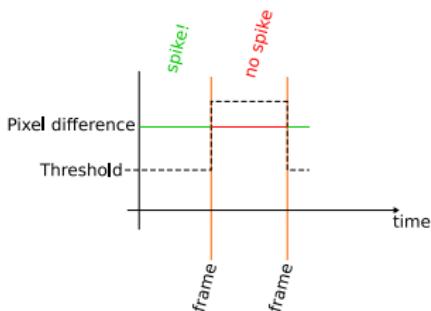


Convert images/video to spike trains

- Based on eye anatomy[2]
- Retains visual information
- 12 fps + correction algorithm



- Emulate Dynamic Vision Sensor
- Sense changes in contrast
- Per-pixel adaptive threshold



- ✓ Familiarized with SpiNNaker & reviewed state of the art
- ✓ Video-to-spike encoder
- ✓ Paper waiting to be reviewed in Frontiers



[TO DO] On-line learning of spiking neural networks

[TO DO] Object recognition and tracking with deep networks

[TO DO] Spiking version of SLAM



# Thank You!

Contact me:

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- [1] M. Milford, G. Wyeth, and D Prasser, "RatSLAM: a hippocampal model for simultaneous localization and mapping," *Robotics and Automation*, ..., no. May 2004, pp. 403–408, 2004, ISSN: 1050-4729. DOI: 10.1109/ROBOT.2004.1307183.
- [2] B. Bhattacharya and S. Furber, "Biologically inspired means for rank-order encoding images: a quantitative analysis," *Neural Networks, IEEE Transactions on*, vol. 21, no. 7, pp. 1087–1099, 2010, ISSN: 1045-9227. DOI: 10.1109/TNN.2010.2048339.

