UNIVERSITY of WASHINGTON

MECHANICAL ENGINEERING

Insect-inspired intelligence in gnat-sized flying robots

Visual flight control of the very smallest aerial vehicles
NSF #FRR-2054850

Dr. Sawyer B. Fuller
Assistant Professor

video courtesy of Andrew Mountcastle

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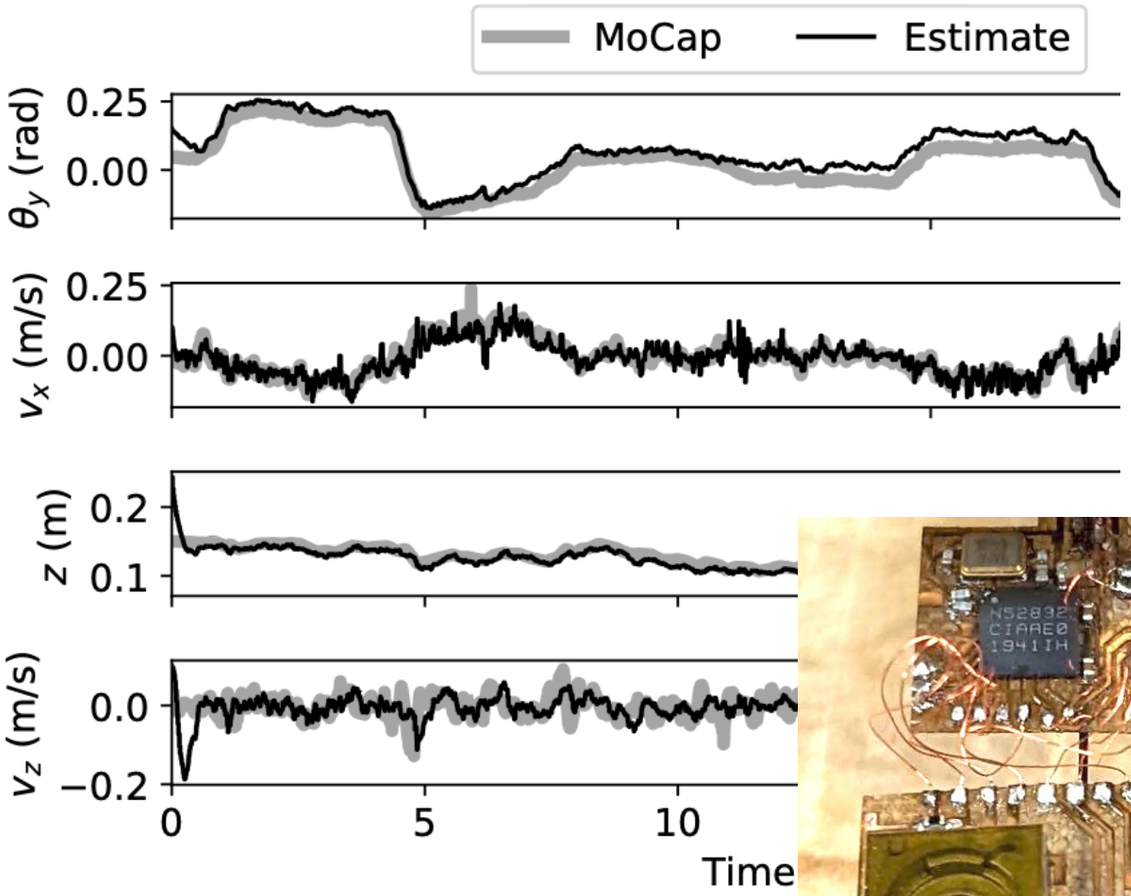
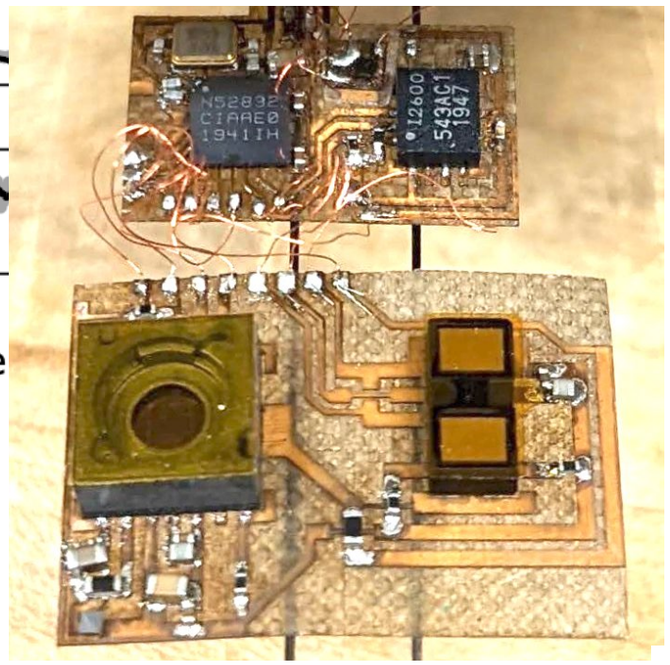
230 mg avionics package
(2 toothpicks)





velocity error ~4 cm/s
attitude error ~3 deg

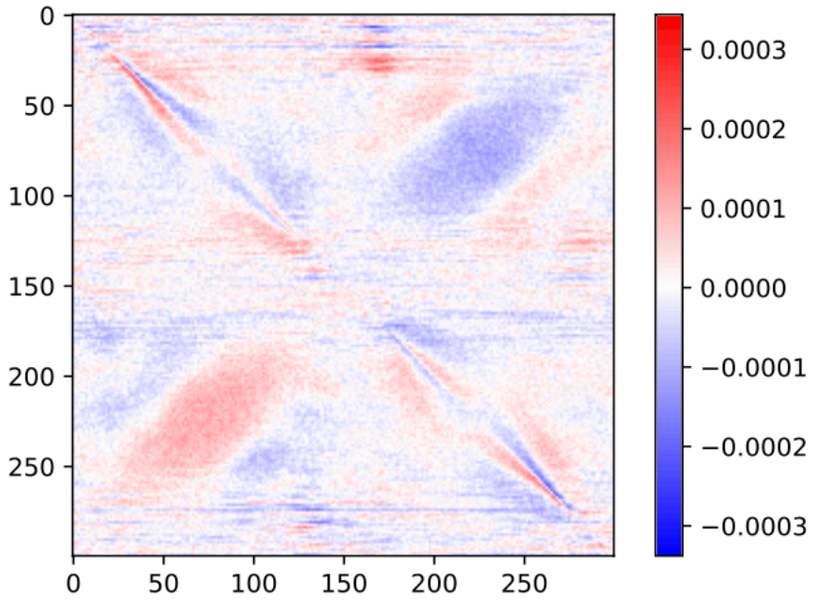
navigation with a single-layer perceptron

dynamics of pixel luminance

$$\dot{\boldsymbol{l}} = (\boldsymbol{s} \times \nabla_{\boldsymbol{s}} \boldsymbol{l}) \cdot \boldsymbol{\omega} + \mu(\boldsymbol{s}, \boldsymbol{p}) \nabla_{\boldsymbol{s}} \boldsymbol{l} \cdot \boldsymbol{v}$$

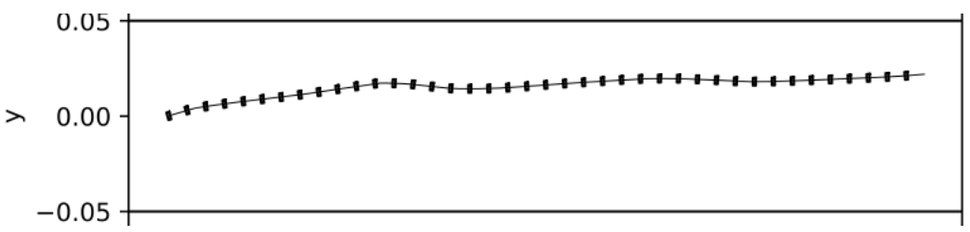
$$\approx \boldsymbol{q}M\boldsymbol{l} \quad \text{(bilinear approximation, } \boldsymbol{q} \text{ is state)}$$

learned weighting matrix M



estimator $\hat{\boldsymbol{q}}_i = c\boldsymbol{l}^\top M_i \dot{\boldsymbol{l}}$

controller $\boldsymbol{u}_i = -K_i(\boldsymbol{q}_{i,d} - \hat{\boldsymbol{q}}_i)$



Talwekar, Adie, Iyer, & Fuller (*ICRA 2022*)

Yu, Zardini, Censi & Fuller (*under review*)