Automated aerodynamic performance estimates for flapping flight

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Motivation
Quantifying aerodynamic performance for freely flying birds is inherently difficult to do without interfering with their natural flight. Many current methods thus combine kinematic parameters derived from high-speed video with theoretical force and power models. However, these methods often require manual tracking of points in each frame of a video to obtain kinematic data [1, 2].

This project utilizes image processing techniques to automatically extract kinematic data (stroke angle and wingbeat timing) from high speed videos of Pacific parrotlets flying from perch to perch. To analyze aerodynamic performance, this data is then used to estimate power requirements based on actuator disc theory [3, 4].

Future Work
- Reduce the number of parameters needed for robust processing of different flight videos
- Automatically identify optimal region for analysis in new videos
- Track beak to adjust for changes in body orientation during flight

Related Work and References
EE 368 projects from past years related to flapping flight:

Results
The processing steps were tested on videos of ascending, descending, and level flights of 3 different Pacific parrotlets. By adjusting a series of flight-specific parameters, stroke angles and all wingbeats were successfully extracted from 30 out of 31 flight videos.