Abstract
This work addresses the problem of autonomous quadrotor navigation within indoor spaces. In particular, we focus on the case where a visual map of the area, represented as a graph of linked images, is constructed offline (from visual and inertial data collected beforehand) and used to determine visual paths for the quadrotor to follow. Moreover, during the actual navigation, the quadrotor employs both the 3+1pt and the 1+1pt RANSAC to efficiently determine its desired motion towards the next reference image, for both cases of sufficient and insufficient baseline (e.g., rotations in place). Lastly, we introduce an adaptive optical-flow algorithm that can accurately estimate the quadrotor’s horizontal velocity under adverse conditions (e.g., when flying over dark, textureless floors) by progressively using information from more parts of the images. The speed and robustness of our algorithms are evaluated experimentally on a COTS quadrotor navigating in the presence of dynamic obstacles (i.e., people walking), along lengthy corridors, and through tight corners, as well as across building floors via poorly-lit staircases.

Main Contributions
- Geometry-based algorithm (3+1pt vs. 1+1pt RANSAC) for selecting the next reference image.
- Algorithm capable of dealing with wide range of motions (e.g., motion along corridors, open spaces, rotations in place) as well as challenging conditions (e.g., specular reflections).
- Ease of use: Define paths by walking through the area of interest with a cell phone.

Problem Description
- Given a quadrotor equipped with navigation sensors, follow a visual path, defined as a sequence of pre-recorded images between the start, intermediate, and final desired locations.

Experimental Platform

Technical Approach (Offline)

Technical Approach (Online)

Controller and Obstacle avoidance

References