DETECTING MOVING OBJECTS IN AERIAL IMAGERY CAPTURED FROM UNMANNED AERIAL VEHICLE (UAV)

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UNMANNED AERIAL VEHICLES

- Extends human reach
- Can be programmed to complete the mission autonomously
- Large area covered
- High resolution images at varying altitudes
- Multi modal imagery – Thermal and Visible
- Clear Aerial overview
- Discrete and Silent – Low noise levels as opposed to helicopters
- Low Cost
UAVs and Computer Vision

- Surveillance – Security and Defence Systems
- Traffic Analysis
- Wildlife Monitoring
- Disaster Response
- Search and Rescue
- Path Planning, Navigation Control

- Maybe Amazon delivery!
SURVEILLANCE AND TRAFFIC MONITORING

- Reconnaissance, Tactical and Security applications
- Border patrol
- Compute traffic metrics automatically
- Detect unusual activities
- Dutch Government deploys drones to get real-time traffic information on route to Concert at Sea festival in Zeeland
- Drones deployed on Mumbai-Pune expressway to monitor traffic and the cause for accidents
Wildlife Monitoring

- Wildlife Monitoring, Population Estimate
  - Namibia Kuzikus Wildlife Reserve
  - Shark patrol
- Detecting wildlife in agricultural land
- Low noise, does not disturb the animals
Moving Object Detection

- Detect moving foreground
- Track them over next few frames
THE FOREGROUND DETECTION PROBLEM

- Global Vs. Local motion (UCF dataset - Actions sample)
CHALLENGES

- Constantly moving background
- Altitude and perspective variations
- Camera jitter
- Changing weather conditions
METHODS FOR ESTIMATING GLOBAL MOVEMENT

- KLT points tracker
- Optical flow
- Moments
APPROACH USED

Previous Frame

Estimate Geometric Transformation

Warped Image

Frame Difference

Normalization and Morphological operations

Moving Foreground
KLT Feature Tracker

- SURF Points extracted from the initial frame
  - detectSURFFeatures
  - extractFeatures

- Track features between frame
  - Create object `vision.PointTracker`
  - Initialize with SURF points
  - Track across adjacent frames
ROLL PITCH AND YAW
**Estimate Geometric Transformation**

- Fit geometric transformation to control point pairs between the Fixed and Moving Frame
  - Estimate ‘Projective’ Geometric transformation - fitgeotrans
  - Apply the transformation to Moving frame - imwarp
  - Adjust the X and Y bounds of the Fixed and Moving Frames
GEOMETRIC TRANSFORMATION
FRAME DIFFERENCING
IMAGE NORMALIZATION
Morphological operations and Connected Component Analysis

- Erosion and dilation - `imdilate`, `imerode`, `imclose`
- Fill holes in binary image - `imfill`
- Remove all connected components that have fewer than p no. of pixels to remove noise - `bwareaopen`
- Find Connected Components - `bwconncomp`
- Measurements - `regionprops`
RESULTS VIDEO
Questions?
Thank You!