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Face Identification Using Micro Flying Robot

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Abstract:
This paper presents Face identification using Micro Flying Robot. In the modern world there were many streams where the drones play a predominant role. They revolutionized the way things work. In defense department drone plays an important role in surveillance. We can use these Micro Flying Robot for face identification. For face identification we can use available software like Tensorflow.

Keywords: Micro Flying Robot, Face Identification

1. INTRODUCTION

A. Motivation

The next decades will lead to revolutionary changes in the technology of micro-electronic devices and micro robotics. The research in miniaturization will lead to innovative technologies achieving greater process intensification and applications, will reduce the cost of space exploration and will increase substantially the ability to perform multiple simultaneous operations.

Micro helicopters (where “micro” means up to the size of a few decimeters and less tan 2kg) has progressed significantly in the last decade thanks to the miniaturization of exteroceptive sensors (e.g., laser rangefinders and digital cameras), and to the recent advances in micro-electromechanical systems, power supply, and vehicle design.

Micro helicopters—and notably multi-rotor helicopters— have several advantages compared to fixed-wing micro aerial vehicles: they are able to take off and land vertically, hover on a spot, and even dock to a surface. This capability allows them easily to work in small indoor environments, pass through windows, traverse narrow corridors, and even grasp small objects

MAV's development started for the use as an uninhabited aircraft that a technological level of nanotechnology is improved and it is small and the cost is low for the search operation in a short distance in the arena of warfare. As other usages, we assume that the scout of polluted area of NBC (Nucleus, Biology, Chemistry) weapons, radio relay in place where communication is difficult, grasp the situation of rescue signal and descent point when the aircraft pilot escapes.

In the MAV we have high end processor so we can use Tensorflow for face identification. In Tensforflow we will train using the existing photos.

Fig. 1. SLFY design of micro flying robot

B. SFLY project on micro flying robot

SFLY focussed mainly on 1) micro helicopter design, 2) visual 3D mapping and navigation, 3) low power communication including range estimation and 4) multi-robot control under environmental constraints. It shall lead to novel micro flying robots that are:

- Inherently safe due to very low weight (< 500g) and appropriate propeller design;
- Capable of vision-based fully autonomous navigation and mapping;
- Capable of coordinated flight in small swarms (3-5 robots) in constrained and dense environments.

In order to achieve these challenging overall goals of the project, major progress is required in the following fields:

- Advance micro helicopter technology in order to build fully autonomous flying robots that are below 500 g, have long flight autonomy and are inherently safe.
- Development and evaluation of flight stabilization and fully autonomous navigation using monocular vision as the only exteroceptive sensor.

- Obstacle detection and avoidance using optical flow and structure from motion
- Vision based SLAM with limited calculation power and memory
- Low power communication using GSM and local wireless system
- Distance estimation between air vehicles using local wireless system
- Optimal control of groups of micro-helicopters under various constraints.

2. SFLY DESIGN AND ARCHITECTURE

A. System Design

One goal of the SFLY project was to have a vehicle as small, lightweight (less than 1.5kg), and safe as possible, while being capable of carrying and powering an onboard computer and cameras. Since the SFLY helicopter was envisaged to operate in urban environments, the impact energy had to be reduced to a minimum. To limit the risk of injuries, studies were made to evaluate the effects of having more than four (but smaller and safer) rotors on efficiency achievable dynamics and redundancy. These studies are presented in detail, the smaller the numbers of rotors, the better the efficiency of the vehicle

The SFLY platform runs most computer-vision algorithms fully onboard. This demands high onboard-computation capabilities. In the first SFLY vehicle, a 1.6 GHz Intel Atom computer was used; however, in the latest platform, this was replaced with a Core-2-Duo onboard computer able to process all flight critical data on-board.

The SFLY robot is made of hexagon-shaped six-rotor design because there is a greater number of single-rotor failures, thus, enabling safe operations in urban areas. In octocopter design the thrust in a redundancy situation is smaller but the overall efficiency is higher in six rotor model.

B. Autonomus Navigation

Autonomous navigation based on onboard 2D laser rangefinders has been largely explored for ground mobile robots. Similar strategies have been extended to MAVs to cope with their inability to “see” outside the scan plane. This is usually done by varying the height and/or the pitch and roll of the helicopter, and by incorporating readings from air-pressure and gyroscopic sensors. The system was extended to incorporate data from an Inertial Measurement Unit (IMU) and, thus, estimate the absolute scale automatically while self-calibrating all the sensors

C. Electronic Architecture

Except for the two additional motors, the electronic components and the software architecture are about the same as the Asctec Pelican described in [9]. A distribution of the FlightControl-Unit’s (FCU) main task between two microprocessors is illustrated in Fig. 2. The so-called Low Level Processor (LLP) handles all hardware interfaces; it is connected to the sensors and computes the attitude-data-fusion and flight control algorithms at an update rate of 1 kHz. The High Level Processor (HLP) is open for customized or experimental code. In the SFLY project, the HLP is used for state estimation and control. It has proven to be helpful to have the LLP as a safety backup while performing experiments in flight.

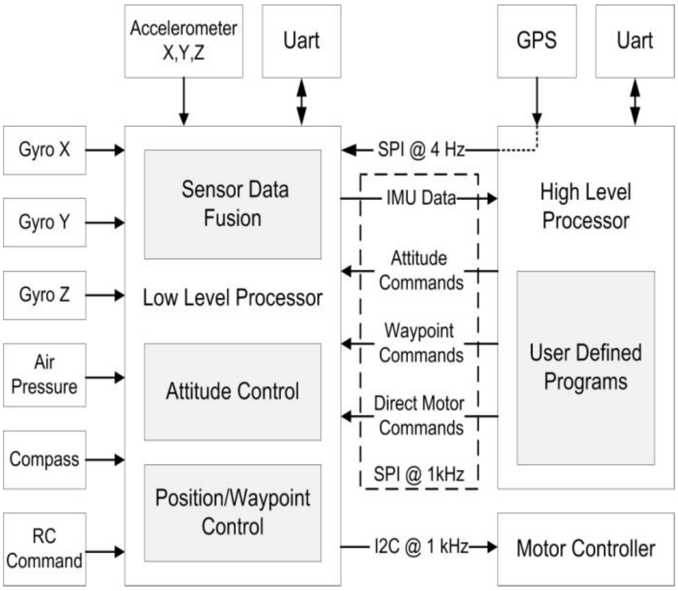


Fig. 2. Electronic architecture: All sensors, except the GPS, are connected to the LLP which communicates via I2C with the motor controllers and via SPI with the HLP.

D. Onboard Computer

To integrate all computational intense parts onboard the vehicle, the initial Atom computer board of the Pelican platform was not sufficient. Therefore, the ongoing development of a new motherboard supporting the COM express standard was pushed forward to support the integration of a Dual Core Atom, a Core 2 Duo, or a Core i7 CPU unit. These computer boards provide enough computational power to run all onboard software. Furthermore, additional interfaces like Firewire and hardware serial ports are supported. Especially, the hardware serial ports are another step towards precise and fast state estimation on the onboard computer as the latency is reduced to a minimum.


Fig. 3. On-board computer AscTec Mastermind featuring a Core 2 Duo CPU

3. FACE IDENTIFICATION

A. Difference between face detection and face identification

- **Face Detection**: it has the objective of finding the faces (location and size) in an image and probably extract them to be used by the face recognition algorithm.
- **Face Identification**: with the facial images already extracted, cropped, resized and usually converted to grayscale, the face recognition algorithm is responsible for finding characteristics which best describe the image.

B. *Face Identification Algorithms*

There are different types of face recognition algorithms, for example:

- Eigenfaces (1991)
- Local Binary Patterns Histograms (LBPH) (1996)
- Fisherfaces (1997)
- Scale Invariant Feature Transform (SIFT) (1999)
- Speed Up Robust Features (SURF) (2006)

C. *How Face Recognition works?*

Face recognition is done by comparing face representations rather than comparing actual faces. This means that a facial recognition algorithm goes through a face and extracts the features of the face. This process is often called template/vector generation or facial feature extraction. At the end of that process, we are left with 5KB of a text string which represents a 2, 5 or 10 MB photo. So, when the matching process takes place, it matches a text string against a data base of text strings, which is obviously faster and much more efficient than comparing photos.

This Micro Flying Robot has high end processor so by using face identification software

4. FACE IDENTIFICATION SOFTWARES

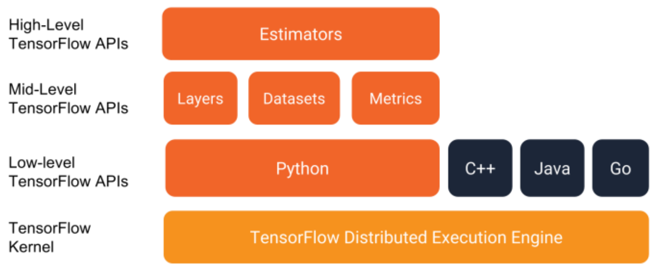
Any of the following software can be used in the MAV's for face identification

A. *TensorFlow*

TensorFlow is Google Brain's second-generation system. Version 1.0.0 was released on February 11, 2017. While the reference implementation runs on single devices, TensorFlow can run on multiple CPUs and GPUs (with optional CUDA and SYCL extensions for general-purpose computing on graphics processing units). TensorFlow is available on 64-bit Linux, macOS, Windows, and mobile computing platforms including Android and iOS.

Its flexible architecture allows for the easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices.

TensorFlow computations are expressed as stateful dataflow graphs. The name TensorFlow derives from the operations that such neural networks perform on multidimensional data arrays. These arrays are referred to as "tensors". In June 2016, Dean stated that 1,500 repositories on GitHub mentioned TensorFlow, of which only 5 were from Google



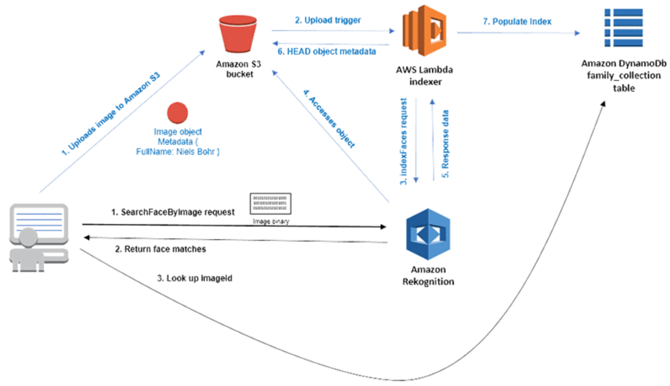
B. *OpenCV*

OpenCV (Open Source Computer Vision) is a popular computer vision library started by Intel in 1999. The cross-platform library sets its focus on real-time image processing and includes patent-free implementations of the latest computer vision algorithms. In 2008 Willow Garage took over support and OpenCV 2.3.1 now comes with a programming interface to C, C++, Python and Android

C. *Amazon Rekognition*

Amazon Rekognition makes it easy to add image and video analysis to your applications. You just provide an image or video to the Rekognition API, and the service can identify the objects, people, text, scenes, and activities, as well as detect any inappropriate content. Amazon Rekognition also provides highly accurate facial analysis and facial recognition on images and video that you provide. You can detect, analyze, and compare faces for a wide variety of user verification, people counting, and public safety use cases

Amazon Rekognition is based on the same proven, highly scalable, deep learning technology developed by Amazon's computer vision scientists to analyze billions of images and videos daily, and requires no machine learning expertise to use. Amazon Rekognition is a simple and easy to use API that can quickly analyze any image or video file stored in Amazon S3. Amazon Rekognition is always learning from new data, and we are continually adding new labels and facial recognition features to the service



D. *Face-Six*

Face-Six is a global face recognition vendor, which develops and markets cutting edge facial recognition software. Face-Six offers ready-to-use solutions to the government, commercial and private sectors. Its recognition accuracy can reach 99% with the right conditions, which are good lighting, good camera

5. LIMITATIONS IN FACE IDENTIFICATION

A. *Image Quality*

Image quality affects how well facial-recognition algorithms work. The image quality of scanning video is quite low compared with that of a digital camera. Even high-definition video is, at best, 1080p (progressive scan); usually, it is 720p. These values are equivalent to about 2MP and 0.9MP, respectively, while an inexpensive digital camera attains 15MP. The difference is quite noticeable.

B. *Image Size*

When a face-detection algorithm finds a face in an image or in a still from a video capture, the relative size of that face compared with the enrolled image size affects how well the face will be recognized. An already small image size, coupled with a target distant from the camera, means that the detected face is only 100 to 200 pixels on a side. Further, having to scan an image for varying face sizes is a processor-intensive activity. Most algorithms allow specification of a face-size range to help eliminate false positives on detection and speed up image processing.

C. Face Angle

The relative angle of the target's face influences the recognition score profoundly. When a face is enrolled in the recognition software, usually multiple angles are used (profile, frontal and 45-degree are common). Anything less than a frontal view affects the algorithm's capability to generate a template for the face. The more direct the image (both enrolled and probe image) and the higher its resolution, the higher the score of any resulting matches.

D. Processing and Storage

Even though high-definition video is quite low in resolution when compared with digital camera images, it still occupies significant amounts of disk space. Processing every frame of video is an enormous undertaking, so usually only a fraction (10 percent to 25 percent) is actually run through a recognition system. To minimize total processing time, agencies can use clusters of computers. However, adding computers involves considerable data transfer over a network, which can be bound by input-output restrictions, further limiting processing speed.

6. EXPERIMENTAL RESULTS

A. TensorFlow

Using TensorFlow we ca identify image or face based on the training we give to the software

This image shows the object identification using TensorFlow

B. Face-Six

This facial recognition software is highly accurate! There are several techniques to measure face recognition accuracy, but generally speaking our software reaches 99% accuracy under a control environment. Although real life conditions might be dynamic and can't always be controlled, it is quite possible to pre-configure all the necessary requirements and to achieve close to optimal conditions.

C. Amazon Rekognition

In Amazon Rekognition we can use to find the text written on the paper and the face identification is mostly accurate. This can also give facial analysis

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