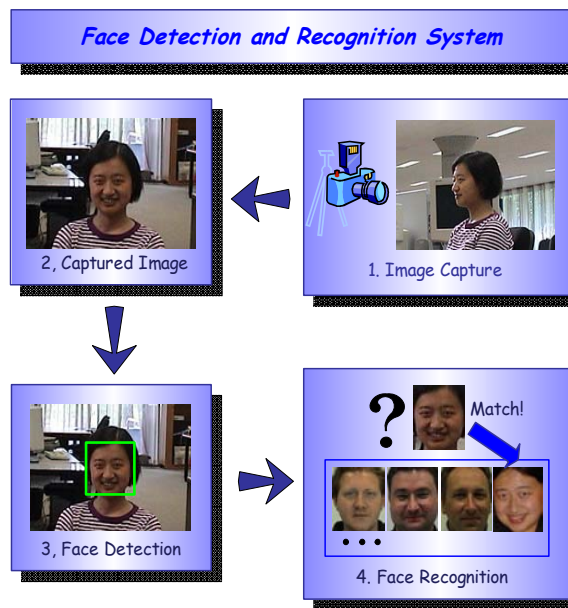


Face Detection and Recognition for Smart Home Applications

An embedded software-based person identification technique

Recent advances in high-performance software and hardware systems enables the application of intelligent, reliable and convenient services in ordinary life. We developed a distributed embedded system that can automatically identify persons approaching a camera. The system utilizes modern face detection and recognition technologies and algorithms were designed for fast and efficient processing. The application acts as a 'smart' person recognizer for home applications without human intervention.



System requirements and aspects

The face detection and recognition system utilizes a video camera and a normal PC to perform the person identification tasks. It should:

1. Detect faces from the still images (or live video sequences). There is no restriction to the background and the number of faces.
2. Handle the varying conditions in a consumer environment.
3. Recognize faces by comparing the captured face images to a database of known faces. A decision is then made about the identity of the person (either one of the faces in the database, or not belong to the database at all).
4. Enable that the face detection and recognition stages can take place at different locations in a home.

Face detection and recognition

The face detection and recognition system consists of three components: face detection from complex scenes, face normalization and face recognition.

The **face detection** utilizes hybrid feature detection techniques to ensure both robustness and processing efficiency. The faces are extracted using color, gray-level structure and neural-network based techniques.

The **face normalization** localizes the important facial feature points (such as iris centers) and normalizes the face by scale, illumination and position.

The **face recognition** performs the actual face matching by using eigenface representations and a linear discriminant analysis method.

Specification of the experimental platform

The face detection and recognition system is software-based and works under the Linux operating system.

1. Input: still pictures of varying formats; live video from a DV camera (S-Video) or a web camera (USB).
2. Recommended hardware: a PC with at least 500MHz CPU and 128MB memory.
3. Environment: diffuse lighting preferable.
4. Processing speed: for QCIF frames, the system can process 3 frames per second on a Pentium IV PC of 1.7GHz.
5. Only frontal view (or near frontal view) face images are currently supported.

Perspectives

Despite the current use of a PC, the adopted design techniques and algorithms in the designed system allow integration into larger systems in the near future. The embedded face detection and recognition system can be used in a variety of applications. These include:

1. Automatic person identification for control applications.
2. Home surveillance.
3. Computer access and security.
4. Intelligent home applications, such as personalized TV and databases.

For more information, please contact

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About us

This work is carried out by the VCA (Video, Coding and Architectures) group (Depart. Electrical Engineering, Sign. Proc. Systems), at Eindhoven University of Technology, The Netherlands.

The group is involved in the following areas:

1. Video compression and coding techniques and related standards and their (embedded) applications.
2. DSP Architectures for video coding and processing systems, or embedded systems where visual information is processed or stored.
3. Video segmentation and object detection / recognition, and their applications.

Other ongoing Projects

1. In-home server SW architecture using digital multimedia.
2. Complexity-scalable MPEG encoding for mobile video applications.
3. Video segmentation and MPEG compression.
4. Multimedia applications and software middleware architecture (ITEA Space4U).
5. Advanced video processing in surveillance cameras.
6. Video scaling for television systems.
7. Fast searching in MPEG-based recording systems.

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