SenseCam Visual Diaries Generating Memories for life

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The SenseCam is a small wearable personal device developed by Microsoft Research in Cambridge, UK. It incorporates a digital camera and a number of various sensors which include a light sensor, an accelerometer, an ambient thermometer, and a passive infra red sensor, all of which contribute to the capture of a "good" image. Good images from the users point of view might contain a person, or change of scenery while at the same time an image should be taken while the camera is stationary to avoid blur. The SenseCam also incorporates a fish eye lens which captures what the wearer is currently viewing. Once turned on, SenseCam images are passively captured and stored every fifty seconds by default unless automatically triggered by the sensors resulting in the automatic capture of up to 3,000 images per day. This resulting data captured can be thought of as a visual diary of a wearer's activities. In addition sensor data is captured and aligned with the captured SenseCam images. Reviewing of SenseCam images has been shown to improve short-term memory yet when reviewing, it clearly becomes evident that successful implementation of intelligent techniques are necessary for effective searching and browsing of a SenseCam archive. The continuous passive capture of images results in large archives and makes it difficult to access and browse the SenseCam archive. In this abstract we describe the automatic analysis structuring of thousands of SenseCam images into easily browsed visual diaries of each day's activities based on identifying important or significant events in a person's life.

Automatic Structuring of SenseCam Photos.

Imagine the following typical scenario. During a typical day in the life of John he gets up at 7.00am each morning. Between 7.00am and 8.00am he has breakfast, then he cycles to work, following the same route, arriving at 9.00 am. He sits at his desk and works until 10.30am, at which time he joins his colleagues for morning coffee. This is followed by another couple of hours at work, including occasional meetings, until 1pm. He takes an hour at lunch before returning to an afternoon of work at his desk, broken up by people entering his office asking for advice and discussing issues about a research project. At 6 pm he leaves work and cycles home, he eats dinner at 7pm, watches TV and goes to bed at 10pm. Subsequent days may have a similar pattern of activity but John may decide to go to a soccer game after dinner one evening, or meet friends whom he has not seen in a while for lunch or coffee. The latter activities would be significant or

important when considered over a period of a number of days while his other activities, meals, travel and work, are recurring and vary little from day to day. Within our daily lives we refer to an "event", as a period of the day when some identifiable or specific activity happened such as having breakfast, going to work, in a meeting, or meeting a friend etc. It is important to be able to segment and identify these events automatically. However SenseCam event detection poses a challenging task due to the nature of SenseCam images. Consider for example a wearers daily activity; eating breakfast. An image is taken every 50 seconds by default, however movement in any direction by the wearer, may trigger the capture of another image due to light change or other sensors triggers. The few images taken during this movement are very different from their adjacent images however they are still part of the same event. Automatic event detection, overcoming this problem, has been achieved using various techniques including the utilisation of a combination of low level features, spatiograms and temporal constraints to compare adjacent and near adjacent images.

Once the automatic detection of events is achieved, we can then further organise and structure these events by detecting regular events that occur throughout a defined period of time which in turn identifies those unique or novel events that occurred and may be of particular interest to the user. The automatic detection of an events' novelty value over a day, is achieved firstly, by comparing the visual similarities between the sets of images that compose an event, for each event over a fixed seven day window and then examining the events duration.

Finally a visual summary of the individual's day can be presented in a browser, with emphasis being placed on the significant or most novel events that may have occurred during the individuals day as shown in Figure 1. This browser presents the representative image from each event according to each events novelty score, with the relative size of the images being indicative of the relative novelty value of each event, during that day. This enables an individual to browse through a visual summary of their day.

We believe that the automatic creation of a personal visual diary of a individuals day's activities, the automatic image processing into specific events and the subsequent presentation of this diary in term of the various novelty values of the events, can greatly improve accessing and navigation through the visual diary of a persons life and hence aid in their retrospective memory. The system described above has been developed and takes as input all SenseCam images recorded by a wearer, automatically processes them to extract events and presents the daily activities to the SenseCam wearer via a interactive interface browser. The data used to test the system consists of five months of continuously captured images by a dedicated wearer.

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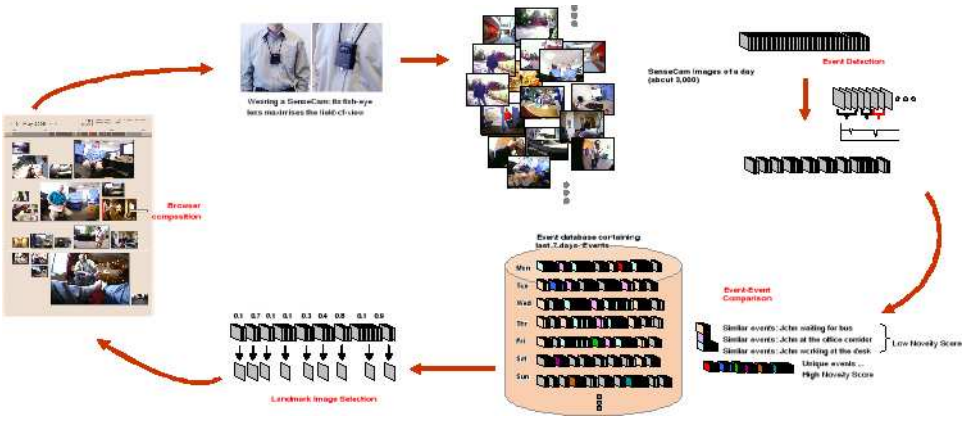

Fig. 1. SenseCam Visual Diary creation