MEDIA AND ACTIVE DOTS OPTIMAL DEVELOPMENT STRATEGIES

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Received 29 December 2007, finally accepted 4 August 2008

Abstract. *Media dots* is a term which describes elements used for reception and processing of media data. Potentially, they can be used in systems of protection and supervision, smart house systems, media-content control systems of an educational institution etc. The examples of existing complexes of video-supervision and projects of some systems are considered. The assumption on general character of processes of reception and processing of media data of various purpose systems is done. The opportunity of creation of the unified means of the user interface and systems of parallel working programs of agents processing, which are carrying out a recognition of situations (intellectual detecting) and formation of reactions, are discussed. The tasks and problems of the further researches are formulated.

Keywords. Media dots, active dots, intellectual agent, intellectual detecting, smart house, user graphic interface, natural behavior strategies, security signal system.

Short title of the paper. Media and active dots.

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„We need men who can dream of things that never were."
John F. Kennedy, 35th President of the USA

Introduction

In connection with avalanche growth of volumes of the transmitted information and capacity of carriers of the data, there is an urgent task of formation of the general concept of processing of large-scale flows media data. The concept of media dots, which are understood as every possible source of media data, is formulated. At the same time, in discussion of problems of object management, a metaphor of active dots uniting various management executive devices can be useful.

The association of various sources of media data within the framework of the uniform concept allows generalizing a task of developing of the context-dependent systems of graphic user interface (GUI) as well as intellectual means of control and management.

These means or, otherwise, intellectual agents, being in media dots space, can solve tasks appropriate to a special-purpose designation of systems and to have many similar features. Hence, the various systems based on the use of means of a video and audio-control can be managed by functionally close program systems. One of kinds of similar technical systems (but not unique) are IP cameras. It is quite possible to consider a community of the program agents placed in a network. Therefore, the systems of recognition (for example, image recognition), systems of video-supervision, systems of the media-content collection in educational institutions etc. can operate. Alongside with it, the intellectual agents can be characterized by their specific behavior which ensures the achievement of the purposes that a system is facing. The behavior of similar systems can have much common with a behavior of artificial alive essences - animates.

1. Avalanche growth of volumes of the transmitted information and capacities of carriers

The growth of capacities of information carriers is an objective process, which is observed during all computer history. Generally, this process is another display of the famous Moore's law [1]. Periodically, alongside with the avalanche growth of volumes of the transmitted and stored information, the expansion of number and change of popularity of carriers of the data are observed. The increase of its quality and volume leads to a necessity to store and to process Terabytes and Pentabytes [2]. On the one hand, this is a treasure, but, on the other hand, it is a „breed", in which to reach useful „layer" is not so easy. One of particular ways of the task solution of the data large volumes is the segmentation or personification of Internet-space [3]. However, the issue is not limited in information searching in the Internet. There are information media-sources, which transfer the data in a real time scale, for example, technological computers, measuring instruments and sensors, IP-cameras, video-servers etc.

2. Media-active dots

Let us consider various media data sources.

1. Systems of video-supervision, which can be advanced up to monitoring systems of city or area (Fig.1). The example of the project of the monitoring system of a city area is described, for example, in [4].
2. The systems of „smart" buildings that can be as well a rather volumetric media-data source are considered [5, 6]. The monitoring system and managements of a „smart" building can contain some media-data sources intended for supervision of the condition of rooms and technical subsystems, and also management blocks (Fig.2).
3. The project of a mobile system of supervision (Fig. 3).
4. The systems of security supervision, in which increasing popularity is won by IP-cameras [7, 8]. Modern variants of the systems of video-supervision and security signal system include algorithms of recognition of people, cars and some situations (sharp acceleration of movement, a person falling etc.) [9].
5. The monitoring system of warehouses and rooms, with adjustable zones of the control. One of the most popular tasks in these systems is the systems of face recognition [10].
6. The systems of supervision and control used in educational institutions, for example, at schools [11], where the cameras are used for the control of study rooms and sports grounds.
7. The project of a control system educational content of higher-school (Fig.4). The general concept of the system is illustrated in Fig.5. Generally, an educational media-content formed by the teacher can be transferred directly in a network in a real time scale and saved on the server. The isometric projection of the building is used for control learning content. The user selects the floor of the building by a mouse strike (Fig. 4, fragment A; Fig. 6), then they select a media dot on the floor scheme (Fig. 4, fragment B).

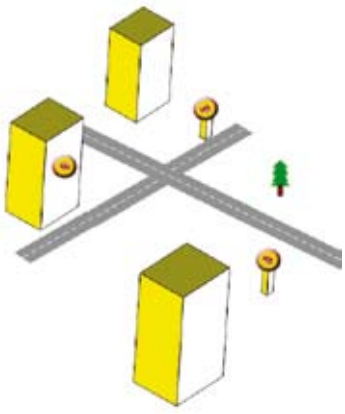

Fig. 1. Town control system.

Fig. 2. Media-Active dots in a SMART HOUSE. The green signs are media dots, the red ones are active dots.

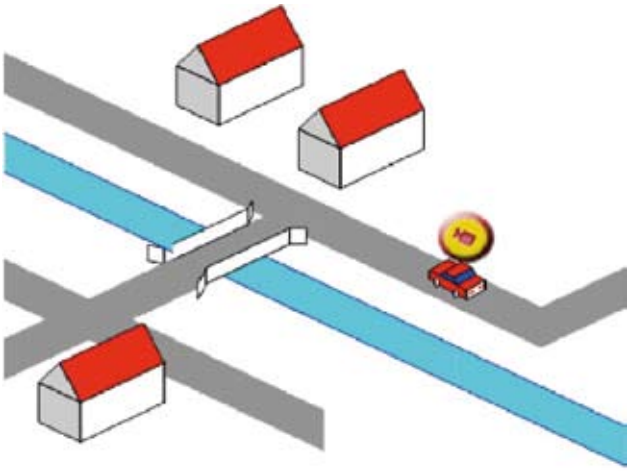

Fig. 3. Mobile M-dots.

Fig. 4. Graphical user interface for control media dots in a higher school.

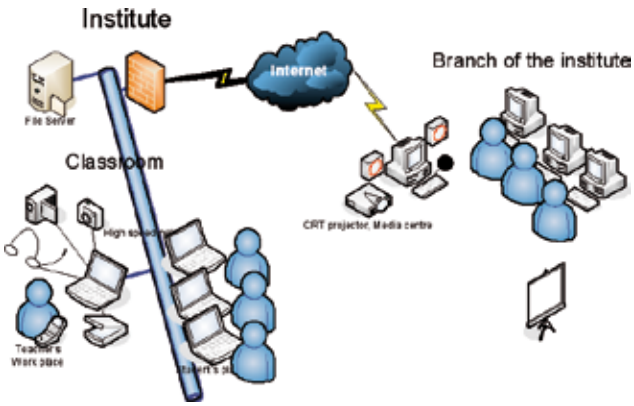

Fig. 5. Concept of a higher school e-learning system.

Fig. 6. Floor scheme.

The various media-information sources can be generalized by using media-dots concept.

Let us call a *media* or *multi-media dot (M-dot)* as an element which is capable to accept and/or reproduce media data. By media data we understand any kind of data which can be perceived or is reproduced by modern computer and communication means and their combinations. First of all, we shall consider audiovisual data - a video and sound. On the other hand, the *active dot (A-dot*) is an element capable to control an object or system. We shall call this pair as an MA- dot or simply MA. A practical variety of media-information sources can be presented in the following examples.

Examples of M- dots:

i) WEB-pages;
ii) WEB-cameras;
iii) IP-cameras;
iv) computer (e.g. information on its screen);
v) measuring instruments and sensors.

Examples of A-dots:

i) control facility of a „smart" house. Regulators of heat providing devices, illumination devices;
ii) computers;
iii) alarm devices;
iv) restriction access devices;
v) control facility mobile devices.

There is an obvious question- whether the association of so diverse systems and media-sources is justified within the framework of general paradigm? To our mind, in all examples above, the needs of practical use are rather similar. In all cases, the reception and processing of media data, and, as a rule, a real time scale is meant. Firstly, the context-dependent means of GUI that ensure the simplicity of access to media-information sources are necessary. An example of the project similar to GUI for media-content management of higher school is described below. Secondly, there is a need for the intellectual means

of control and management allowing lowering the volume of the processed data up to a „reasonable" level by selecting only that data which corresponds to a special-purpose systems designation or user needs. Such means or intellectual agents can act autonomously, prepare timetable of viewing for users and detecting systems.

3. IP-cameras and intellectual detecting

An IP-camera supplied with a microphone becomes a source of a video and audio-information. When wireless communication is available, an IP-camera is capable to work at distance up to several tens meters from the access point. An overview of cameras considered in [13].

For camera management, the software as commercial [14, 15, 16], and conditional free-of-charge [17] are used. Many manufacturers deliver the advanced software together with IP by cameras. As a rule, the cameras are capable to react to the following events [18]:

i) change of a level of a sound, perceived by a microphone;
ii) switching a source of a signal (for example, from an infra-red camera to a usual video-camera);
iii) movement;
iv) change of light intensity;
v) approach of given time intervals.

A camera makes record of video signal or sequence of frames. In other words, modern cameras are capable to detect signals. An intellectual system should be capable of something more. By i*ntellectual detecting* we shall now define the ability of a system to react not only to signals, but also to images. Such a task can be solved by the *agent of intellectual detecting* by expanding the list of recognized situations in the field of camera view span. Generally, the agent can memorize and recognize both static and dynamic images. In this case, media recognition of dynamic images becomes basic. The first step in this direction is the Advanced Video Motion Detection and Unattended Object Detection technology, used in cameras of new generation [19]. As the development of the movement detector (video motion detector) the detector of criminal situations can be offered. The prototype is the system described in [8], where are applied in both stationary and mobile cameras. It is as well possible to speak about *detectors of technogenic situations*, which could serve for revealing dangerous situations, for example, connected with vehicle movement, risk situations at airports, factories etc., and also unusual condition different from habitual situations, which can be an attribute of danger etc. The *agent of intellectual search* in media-dots space can serve as a means of recognition of similar images in media-dots space, searching for particular objects etc.

4. Strategies of media data processing. Model of random work scanning of security space

There are some serious technical problems in data volume processing. The ways of solving these problems, w hich we can point out as most effective, are as follows.

1. Development of optimal strategies of server (or processor) charging, designated for software agents. The choice of processors, when the charging and distance to the source are taken into account, can diminish the probability of errors in data processing.
2. Self-teaching of agents. Using of various strategies of agents' self-teaching, including imitation of natural ways of teaching [20,21], will allow to adopt them for changes in media-ponts space.
3. Use of strategies of transmitted media-information volumes. The first approach can be concluded in dislocation of agents of intellectual detection directly in collection points of media-data. Thus, the translation of a part of algorithm of data processing closer to the point of data receiving can diminish the data amount for the next stage of data processing. Nowadays, there are examples of video-cameras with mounted software which detect the movement and recognize available subjects [15].
4. The second approach is focused on using the pseudo-chaotic strategies of media-points activation, similar to a natural way of vision field of human eye. For instance, to solve the problem of security video-observation, we cannot implement the full-scale processing of the whole data flux, coming from all observation cameras. It will probably be enough to analyze particular images of video-data from various cameras chosen at random. This approach is demonstrated in Fig. 7, 8 and 9. In particular, the Fig.7 shows the „linear set" (security wall) model. Each camera scans the observation field randomly changing the orientation angle $\varphi(t)$. The same way is used for the „radial set" model (Fig.8). Fig.9 demonstrates the algorithm of movement of the video-camera. The orientation angle $\varphi(t)$ changes according to the logistic map law (e.g. the well-known logistic map of Verhulst) [22,23]:

$$x_{t+1} = rx_t(1 - x_t) \qquad (1)$$

For 3<r<4 the generation of chaos is observed. Thus, the algorithm of random walk scanning of active media dot is:

$$\Delta\varphi_{t+1} = 90^{o}[(rx_t(1 - x_t) - 0{,}5] \qquad (2)$$

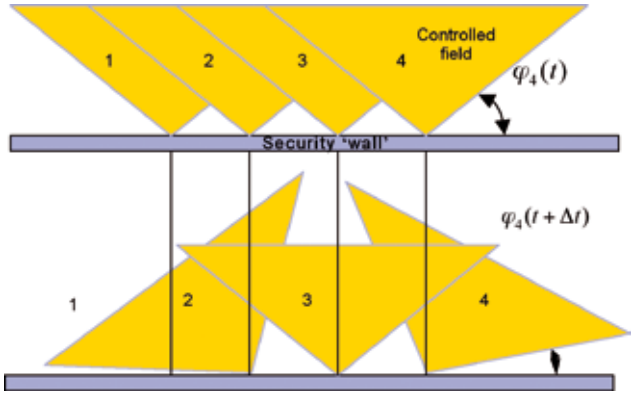

Fig. 7. Media and active dots models: linear set of dots

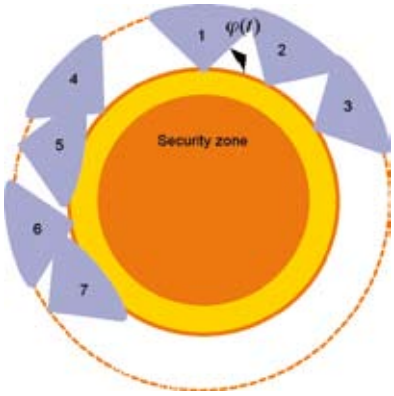

Fig. 8. Media and active dots models: dot radial set.

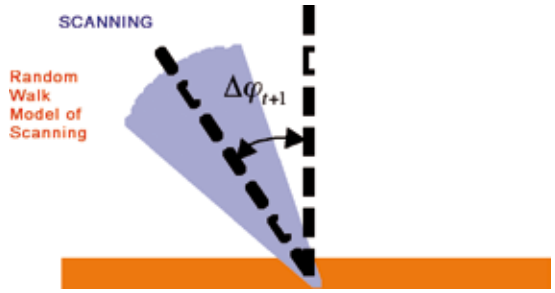

Fig. 9. Random Walk Model of Scanning.

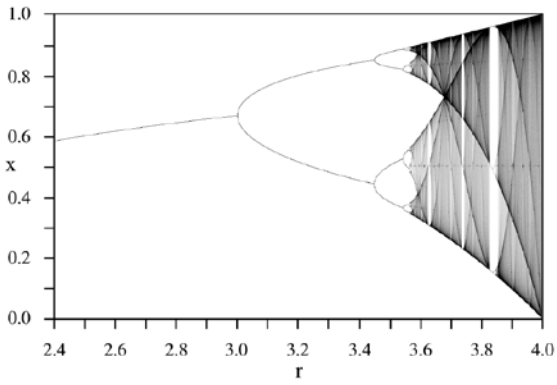

Fig.10. Verhulst's logistic map: the equilibrium point of iterations *x* via the growth parameter *r*.

Random Walk Model of Space Scanning is a chaotically determinated process of rotations of a number of active media dots. As soon as an object is detected, the observation system concentrates its attention on the object and controls it. It is an intellectual action, based on observed image recognition.

The task is to optimize the number of the media-points and their spatial distribution. After detection of an object a system of observation concentrate its attention on the object and controls it. It is an intellectual action, based on observed image recognition. Various types of image recognition systems can be used. Signal systems include algorithms of recognition of the people, cars and some situations (sharp acceleration of movement, fall of the man etc.) (see Fig.11,12).

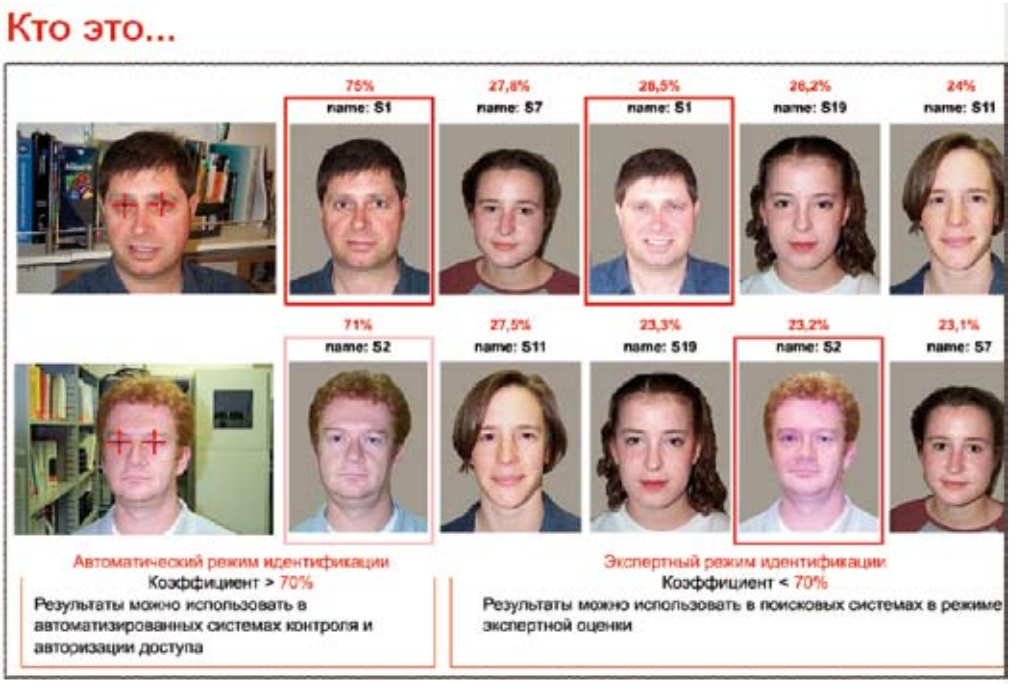

Fig. 11. Face control system.

Fig. 12. Cerberus image recognition system.

Conclusion

An increase of the transmitted data volumes, the growth of speed of transfer and the decrease of storage costs initiates the development of the general concept of media data processing. Considering various sources of media-information within the framework of a media dots metaphor, it is possible to discuss the unified means of the user interface, system of working in parallel programs of processing agents carrying out recognition of situations, and also consider the behavior of the agents in media-dots space.

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