

SIMPLE HARDWARE FOR SEMI-AUTOMATIC STEREOLOGICAL ANALYSIS

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ABSTRACT

Developed system for a semi-automatic stereological analysis in which PC assists the design and presentation (display) of stereological measuring systems which are superimposed on pictures of the analyzed object is described. The development was aimed at simplification of the TV camera - display data-link to minimize the videosegment distortion. The measuring system superimposed on analyzed data display is derived from the signal which drives a VEGA monitor. Design of the test systems which is done by using the PC computer graphics is simple, because the monitor oriented, user friendly SW is used. Good functioning of the developed HW set-up was proved experimentally and it is so simple that it can be assembled by a novice in computer HW domain.

Key words: computer graphics, frame grabber, PC, semi-automatic stereology, TV coder.

INTRODUCTION

The basic problem of automatic image analysis, i.e. the object segmentation is not yet solved in an inexpensive and enough general way thus semi-automatic systems for image and/or stereological analysis are encountered in laboratories [e.g. Moss et al., 1989; Karen et al., 1994] and in serial production [e.g. Grid, 1990] nowadays. Usually the ocular of a microscope or a print are replaced in these systems by a more convenient image display presenting the picture of the analyzed tissue with the measuring raster superimposed. Two basic HW of such systems was already published elsewhere [Krekule and Gundersen, 1989]. These systems differ by superimposition of the computer-generated raster either

- i/ on the video display of the analyzed tissue, or
- ii/ on the picture observed in the microscope.

AIM OF THE DEVELOPMENT

We attempted to design a simplification of the former system by displaying the output of the TV camera capturing the image of the analyzed object directly on a video display,

without the frame grabber intervention thus avoiding a possible image distortion due to videosal AD and DA conversions accomplished by the grabber. The measuring system is generated by the PC by using its monitor-oriented computer graphics SW, which is usually very user-friendly. The measuring system is presented on the PC monitor and, moreover, all standard interactive support is provided (e.g. cursor, mouse, colors etc). The signal which drives the PC monitor (e.g. VGA) is transformed into a standard TV videosal by using a TV coder, i.e. a multimedia born plug-in board of the PC [e.g. see the TV coder by Creative Labs. Inc., USA.]. The transformed signal representing the measuring system is mixed with the output of the TV camera on the input of the TV video display to accomplish their required super-imposition. Both the TV camera and TV coder videosalns must be synchronized which is achieved by external synchronization of the TV camera (see scheme on Fig. 1) by the videosaln of the TV coder. In case the TV display on the screen of which the superimposition of the image of the analyzed object and the measuring system are observed is not equipped with the mixing input, an external mixing of videosalns should be accomplished. We attempted to mix videosalns by their switching by frames. It was a very simple solution but results were not satisfactory because of the blinking of the TV display resulting from the switching. Finally we used an operational amplifier to materialize an additive mixer.

RESULTS

The described system was materialized by using:

- i/ B/W, CCD, TV camera 512x512 pixels (Philips, LDH 0703/30);
- ii/ multimedia TV coder (Creative Labs. Inc., USA) designed for the VGA controller with resolution 640x480 pixels, 8 bits each and NTSC or PAL output video signals;
- iii/ IBM PC/AT 386, 25 MHz; TV video display (Sony KV-M1 400K) and
- iv/ simple additive videosaln mixer. Samples of measuring systems were prepared by using the MS Q-Basic v.7.

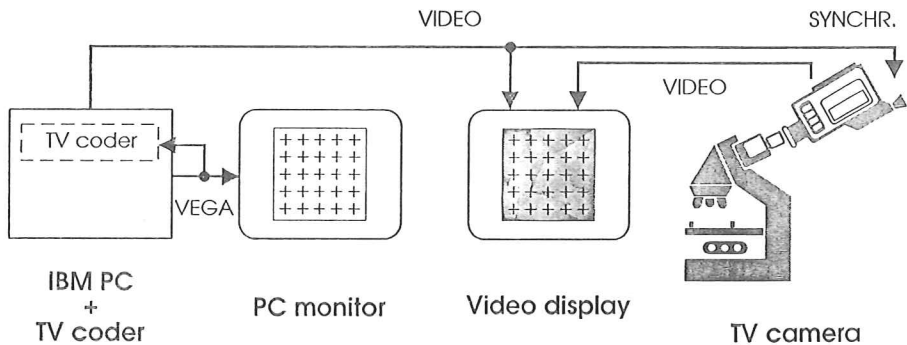


Fig. 1. Scheme of the developed system for semi-automatic stereological analysis.

The developed system was tested by using prints of various tissue samples, which were inspected by the TV camera (see Fig 2). The opportunities of an interactive approach to the analysis (e.g marking counted intercepts, defining the area of interest by using the mouse or setting fiducial marks were evaluated as well. Results obtained during the pilot experiments were satisfactory, confirming feasibility of the described approach.

CONCLUSION

The main advantages of the described HW system for the semi-automatic stereological analysis are:

- i/ its simple design which makes it possible to assembly the system without any deep knowledge of the PC hardware;
- ii/ its lower cost, because the TV coder is significantly less expensive when compared with a frame grabber;
- iii/ good performance and avoidance of the TV videosignal distortion due to the AD & DA conversions done by the grabber;
- iv/ development of the user SW enhanced by its PC monitor orientation.

Loss of an opportunity for on-line digital processing of images of analyzed objects, e.g. restoration, enhancement can be discussed as a disadvantage of the developed system when compared with grabber-based systems. Further development of the described system will be aimed at a direct exploitation of the VEGA monitor of the PC in the role of the TV video display.

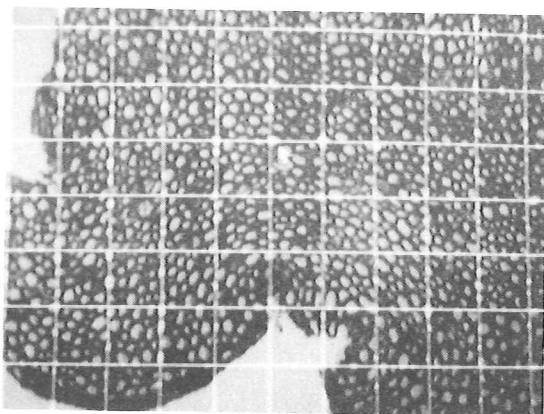


Fig.2. TV video display presenting picture of an analyzed object with measuring system (counting raster) superimposed.

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