Method for Knowledge Acquisition Based on Image Processing for Decision-Making Systems

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Abstract. This work proposes a method of acquiring and updating knowledge based on image processing with application in modern decision-making systems. At the basis of the research carried out is the behavioral model of human beings, which serves as a source of inspiration for the development of the algorithm for acquiring, interpreting, classifying and presenting knowledge. To this end, an empirical analysis of methods and models of knowledge presentation in artificial intelligence systems was carried out [1]. The extraction of new knowledge provides for the acquisition and processing of images based on the stratified Morse Theory, which allows the identification and classification of objects, their placement in depth, in order to update the knowledge specified as real or hidden. The knowledge model is presented in object format compatible with object-oriented programming languages.

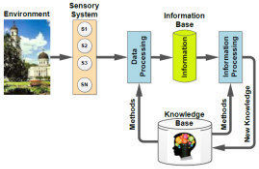

Figure 1. Knowledge extraction and update diagram.

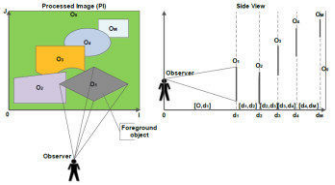

Figure 2. Image acquisition and knowledge identification and classification.

- *Observer* – observation point or video camera for image acquisition;
- *Processed Image (PI)* – the space of the image acquired by the video camera, with the set of objects O_1, O_2, O_3, O_4, O_M, and the background image *O0* (the observer is focused on the object O_1);

- *Side View* – side view of the acquisition system and the depth distance of the objects in the PI image;
- O – origin of the coordinate system; I – pixel coordinate in image horizontally; J – pixel coordinate in the image vertically; d_1, d_2, d_3, d_4, d_M – distance points in depth, to the objects in the image;
- $[d_1, d_2]$ – The distance between objects O_1 and O_2.
- According to Morse Theory, any video image can be layered, resulting in discrete objects placed at depth with each other. The condition for identifying the objects in the image is defined by the expression (1):

$$x(t)[j,i] \in O_m \left| \left(\frac{\partial x(t)}{\partial j} = 0, \frac{\partial x(t)}{\partial i} = 0 \right), \forall\, m = \overline{1,M},\ j = \overline{1,J},\ i = \overline{1,I} \right. \quad (1)$$

Where: pixel $x(t)$ with the coordinates $j,i\ \forall j = \overline{1,J}, i = \overline{1,I}$, belongs to the object O_m, $m = \overline{1,M}$, , if the conditions are met: $\frac{\partial x(t)}{\partial j} = 0$ - which means that the variation of the pixel coordinate vertically does not lead to a change in the $x(t)$, and $\frac{\partial x(t)}{\partial i} = 0$ - which means that the variation of the pixel coordinate horizontally does not lead to a change in the $x(t)$.

*Conclusion***.** In the development of modern decision-making [2] systems based on image processing, an important role is played by the method of acquiring, interpreting, classifying and presenting knowledge. At the basis of the research carried out in the paper is the behavioral model of human beings, which serves as a source of inspiration for the development of decision systems based on artificial intelligence, with image processing at the conscious and subconscious level. To this end, an empirical analysis [3] of methods and models of knowledge presentation in artificial intelligence systems was carried out. As a result, the object-oriented method of knowledge presentation was selected, which is successfully used in object-oriented programming languages.

References

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