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THE DIGITAL IMAGE ANALYSE APPLICATION IN SIGHT CHECKING OF PRODUCTS

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ABSTRACT
This paper is oriented on application of artificial intelligence method –computer vision in automatic sight checking of extrusions. Designed was camera system for identification of strain cracking on products. The software was developed - the user interface with product image, radius deviations changing, histogram, contour points co-ordinations and crack evaluation. Designed workplace consists of measuring table with camera, lighting system and system for checked products positioning and fixation.
Keywords: computer vision, sight quality checking, extrusions, cracks

1. INTRODUCTION
Image analyse is process of application special operation, for example analyse of scene, image compression, construction of 2D or 3D objects models, to image for given purpose. Main task of digital analyse of image is to capture a picture with camera, process it with computer and shows results on output device, or activate systems of control. Mathematics methods are used for image analyse in continuous plane, transfer from Euclid plane to raster plane, they contain Fourier transformation, filtration, light correction, segmentation, contour analyse, morphological transformation and identification of edges. Image focusing is highlights the difference in intensity. All these methods are used in our software, which scans and makes a diagnosis (histogram, contour, final function).
Computer vision can be used in several sectors of industrial praxis. Application fields are in automobile industry, in production quality checking, identification of parts and their parameters for robotics and manipulators systems etc.
Vision system determines the acceptation of objects in quality check system. Application fields are most frequently: the checking of complete configuration, writing of bar-codes and matrix codes, analyses in biotechnologies and medicine, colours identification, counting of objects in production or manipulation, identification of parts position and orientation, checking of defects and cracks, calibration, scanning, dimensioning, material analyse, non-contact measurement of profiles, optical identification, checking of templates, packaging of products, tools monitoring, safety measurements etc.
Sight checking is for workers very heavy and donkey. Human eye get tired during monotonous checking of one place at checked parts. Therefore it is necessary to eliminate human factor in checking operations and supplant it with automatic visual check system.

System for vision processing and identification consist has several functional blocs. There are base elements - the CCD camera and objective, which parameters are selected according to character of check value (colour, form, crack etc.). Video signal from camera is sent to input of digitalizing card. It operates vision data to resulting matrix form, which is filtrated, segmented and evaluated with methods of vision digital processing.

2. COMPUTER VISION APPLICATION IN QUALITY CHECKING

Computer vision system was developed at Department of Machining and Automation, University of Žilina, Slovakia. It was applied in several cases in industry, mainly in robotics. In the field of quality control it was in automatic sight checking of extrusions.
Computer vision system with camera was developed for sight checking of strain cracking in check-out of socket block extrusions. They are made by deep cold pressing technology; the relationship of their depth to diameter is greater than 2 (diameter 10 mm, depth 22 mm). In production are cracks on about 5 % of parts - therefore their quality control is necessary (Figure 1).

Figure 1. Cracks on products

3. COMPUTER VISION PROCESSING

Product image obtaining – in this step it is important to ensure the exact positioning of checked part and correct lighting of workplace. Exact position of object is provided by locating pins.
Selection of image processing sector with effective information is necessary to processing. There is butted and bounded sector by geometric characteristics, which will realise vision processing in. Evaluative sector is **annulus** in this case.
Image segmentation – in this step it is reduced data quantity for object evaluation - image segmentation in annulus.
Segmentation threshold value – boundary line is dedicated inter background colour and object colour by histogram. There is it mean volume of two maximum in histogram.

4. THE DEVELOPMENT OF CHECK SOFTWARE

Error analyse and processing - products defect is identified by geometric characteristics of object inner contour. In figure 2 is visible the deviations of inner contour radius. There is well shown place of deviation location jump from radius mean volume.

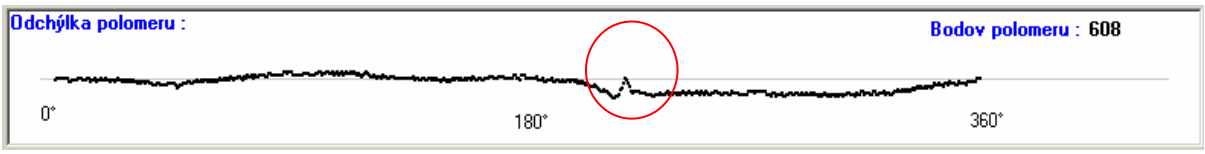

Figure 2. Radius deviations

Software for check evaluation - developed software is dedicated for automated products checking and their processing. Software employs suggested technique and computer vision methods.

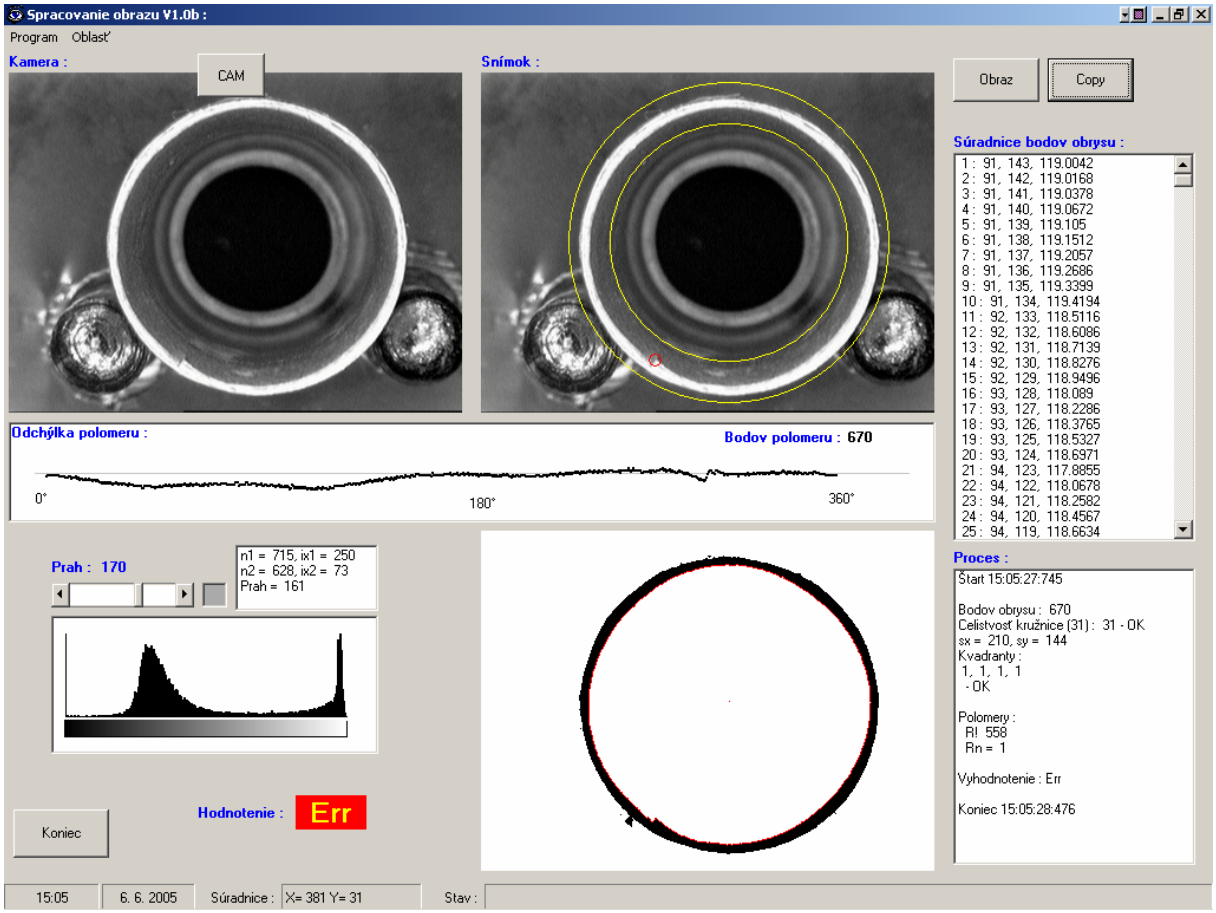

Figure 3. User interface

In figure 3 is shown user interface - the dialog window of software application of products checking by suggested method with computer vision.
The developed software enables to evaluate picture of checked product, which is located in vision check workplace. There is used method of radius change evaluation. The annulus is placed in the middle of top window - it is represented with two concentric yellow circles. Annulus is defined as **working processing area.**
Consequently is made segmentation of annulus with threshold value, which was specified by using scrollbar and histogram. The segmentation threshold value is defined as brightness level between two maxima of counting rate in histogram. The resultant picture after segmentation is located down in the middle of window.
The next step is identification of geometric centre of inner circle and co-ordinates of inner border points. The inner contour is marked by red colour. All co-ordinates are listed in register on the right site of window. There are presented the calculated values of radius too.
There are drawn radius deviations in particular points of inner contour from radius mean volume in range 0 - 360° in the window „Radius deviation“. Radius deviations are processed by mathematics and comparison methods. Place with increasing or decreasing local tendency of radius deviation is searched in data.
If searched place was found, it is marked graphically by red circle and **tested product is evaluated as defected.**
Radius deviation is processed from inner side because the cracks occur during production process on this side. In some cases, cracks are not through whole wall.

5. DESIGN OF WORKPLACE

Workplace was designed for parts picture identification and processing (Figure 4). On workplace has to be suitable CCD camera, which is basic element in check system. We use **SENVIEW TC-323 camera, with TAMRON objective and LT12A monitor with high resolution.**

Camera is attached to table in way that height can be adjusted. Products are attached to check table, exact position of object is provided by locating pins.

Table has suitable light system. Twelve LED diodes with 3mm radius and wave length 568nm illuminate work piece. Diodes were attached directly into holder and placed on camera objective to illuminate work piece from top. Workplace was overshadowed by three walls to reduce day or room light.

Figure 4. Workplace for automatic visual checking

6. CONCLUSIONS

This paper informs about one method of artificial intelligent application – computer vision and image recognition in industrial praxis automation, especially in area of product quality checking – in visual cracks checking on products, which were made by deep cold pressing technology. It shows possibilities of using designed solutions and algorithms of computer vision and image recognition. We developed all presented algorithms, software and hardware solutions. During its development we used general information about computer image processing and applied in Microsoft Visual Basic.

This method can be used in many ways in production process. It is possible to modify developed system for several applications in praxis, mainly for increasing production processes automation level.

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