Mihaela Luca, Adrian Ciobanu

Institute of Computer Science, Romanian Academy, Iaşi, Romania

IMAGE PROCESSING AND FEATURE EXTRACTION IN AUTOMATIC MEDICAL DIAGNOSIS

Abstract

The paper contains a brief overview on our previous research developed in the field of automatic medical diagnosis, strengthening on the recent work, in progress. We are shortly describing more of our medical diagnosis approaches [1–4]: audiometric expert system, hearing impairment fuzzy prediction for professional diseases, bone scintigraphy automatic diagnosis, pulmonary scintigraphy automatic evaluation, thyroid scintigrams analysis, early non-invasive breast cancer detection, fuzzy rule-based support system for haematological diseases classification, and we strengthen on our most recent research, the colonoscopy pre-processing and analysis. Colonoscopy is a time consuming procedure, needing intensive attention and expert assistance. Automatically selecting the risk relevant frames is important both for physicians and for computer assisted learning [5], [6]. From a colonoscopy video we extracted a number of frames, to decrease the computing complexity in order to analyse the abnormal aspects and risk regions. In order to prepare the colonoscopy

image database, we used LAB colour space, a successive selection of entropy levels and histogram transforms. Frames carrying low quantity of information in images with spurious water and air bubbles, residues in the colon and lighting effects due to the colonoscopy procedure itself are discarded. We constituted an image data base using a colonoscopy record and applying more successive procedures in order to pre-process them. For example, from a record we selected a relevant sequence, we extracted 5100 frames, with a resolution of 768×576 pixels, coded RGB on 24 bits, in TIFF format. In order to reduce the computing complexity, and processing time, we downsized the image resolution in two steps, obtaining 5100 RGB images, with a resolution of 192×144 pixels, BMP format. We optimized the parameters of the LAB histograms [7] for all the colours found in these frames, every frame being transformed from RGB to LAB format. Colour features extracted for these frames were used to compute Manhattan distance between two frames, inspecting the colour differences between successive images. Similar coloristic images were grouped in order to be further analysed. In order to automatically identify the useless frames, a multilevel entropy computing on regions was applied on successive frames, in a trial and error procedure, eliminating over 60% of the images, as being non-eligible for further detection of curves, vessels networks and polyps shapes matching, upon a well-structured database indexed in time and contained features towards adenoma automatic identification.

References

1. Costin (Luca), M. Toward a Diagnosis System using Nuclear Medicine Image Processing / M. Costin (Luca), M. Zbancioc, A. Ciobanu, C. Ştefănescu, // ECIT. – 2002. – P. 7–12.

2. Costin (Luca), M. Image Processing in Pulmonary Disease Diagnosis / M. Costin (Luca), C. Stefanescu, D. Galea, M. Zbancioc // IEEE – SOFA 2005, IEEE Intern. Workshop on Soft Computing Applications. – 2005. – P. 231–236.

3. Costin (Luca), M. Imagistic and Data Processing Software for Early Breast Cancer Detection / M. Costin (Luca), M. Zbancioc, O. Baltag, S. Bejinariu. // 12th Intern. Conf. IPMU, Inform. Processing and Management of Uncertainty in Knowledge-Based Systems. – 2008. – P. 89–92.

4. Fuzzy rule-aided decision support for blood cell recognition / H.N. Costin [et al.] // Systems & Artificial Intelligence. – 2001. – Vol. 7(1–3). – P. 61–70.

5. Manivannan, S. Automatic normal-abnormal video frame classification for colonoscopy / S. Manivannan, W. Ruixuan, E. Trucco, A. Hood // IEEE 10th Intern. Symp. on Biomed. Imaging (ISBI). – 2006 – P. 7–11.

6. Mo, W. Content-Based Retrieval System for Endoscopic Images / W. Mo, A. Zanchao Zhang // International Journal of Information Technology. – 2005. – Vol. 11(12). – P. 76–79.

7. Ciobanu, A. Iris Identification Based on Optimized LAB Histograms Applied to IRIS Partitions / A. Ciobanu, M. Luca (Costin), I. Pavaloi, T. Barbu, // Autom. & Calc. – 2014. – P. 37–48.

8. Costin, H.N. Fuzzy rule-based decision support system for haematological diseases classification / H.N. Costin, M. Costin, M. Zbancioc // Proc. Intern. Federation for Medical & Biomedical Eng. – 2001. – Vol. 1. – P. 433–436.