Video stabilizer for Cardiac-MRI (CMRI) perfusion (Ramot)

code: 8-2013-722

Hedva Spitzer, T.A.U Tel Aviv University, Engineering, School of Electrical Engineering
Shahar Gino, T.A.U Tel Aviv University, Engineering, Bio-Medical Engineering
Orly Goitein, Sheba Medical Center

Technology

Several Cardiac-MRI (CMRI) sequences are influenced by diaphragm body motion throughout the respiratory and cardiac cycles. Stabilizing these videos might allow a better medical diagnosis by radiologists. Video-stabilization and ROI-tracking are well-known problems in computer-vision, with many practical applications. However these two problems become even more challenging for medical gray videos, in which separating ROI from its background as well as analyzing its unnatural and fast varying texture, are hard. We suggest a novel algorithm for fort non rigid object and application for CMRI stabilization, inspired by human visual system principles. Video-stabilization is obtained by solving a ROI-tracking problem, and keeping its initial position fixed. The ROI motion is then estimated by linear- and nonlinear approximations, which were used for stabilization. It combines information from both edge and region domains and adaptively weights them according to ROI state. The information on edge and the region was developed in inspiration from receptive fields and mechanisms of the visual system. The proposed algorithm was tried on CMRI videos and appears to achieve promising results. The algorithm is autonomous, self-adapting and requires no user-interference. It is robust to image type and highly-sensitive to objects motion. Moreover, it handles occlusions and deformations and runs in a reasonable complexity. We are also in a process of conducting preliminary clinically tests on our results and other methods results of the same CMRI). In addition we have started a continuation research on developing interventional tool tracking for fluoroscopic X-ray and ablation applications.

The Need

Video-stabilization and Region-Of-Interest (ROI) tracking of mainly non rigid objects are well-known problems in computer-vision, with many practical applications such as surveillance, monitoring, motion-estimation and etc. These applications become even more challenging for gray videos, in which separating ROI from its background, as well as using common computer-vision similarities and features, are less accessible. The reason for this is probably derived from the fact that most of studies on tracking and stabilization made an effort on the most common videos that are with color. Most of the medical images (including CMRI), however, are consisted with achromatic images. The tracked objects in medical media, such as in CMRI, often have a fast-varying texture, smooth edges and a deformable contour; these unique conditions pose the tracking problem again in an unusual manner. A good example for such a challenging video is Perfusion (a.k.a. TC-Short-Axis) sequence of Cardiac-MRI (CMRI), which is a promising non-invasive tool to assess myocardial ischemia. This type of clinical examination is influenced by the diaphragm and the cardiac motion throughout the respiratory and cardiac cycles. This complex motion results a very noisy and trembling video.

Potential Application

In the current version it can be applied for radiological usage for MRI cardiac perfusion.

Stage of Development

We are building the computational tools for enabling us to perform the preliminary clinical tests in order to quantitatively evaluate the algorithm's results. We are also performing comparison evaluations with previous algorithms and methods to tracking rigid and objects.

Patents

Shahar Gino, Hedva Spitzer, Orly Goiten & Eli Konen (2013) Pending patent

Supporting Publications

Shahar Gino, Hedva Spitzer, (2013). Video stabilization and region-of-interest tracking in cardiac MRI

domain. The 4th Israeli conference on robotics 2013

Contact for more information:

Ofer Shneyour ✉, VP Business Development, ICT, +972.3.640.6496

Ramot at Tel Aviv University Ltd. P.O. Box 39296, Tel Aviv 61392 ISRAEL
Phone: +972-3-6406608
Fax: +972-3-6406675