BioWes

dataPartner®

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Module – Image analysis and representation

Technology Agency
of the Czech Republic

... from ideas to applications

Module description

- Software is part of a complex solution for the management of experimental data and metadata. Software is a plug-in for image processing, which is run directly from the Protocol Manager and directly accesses the data protocol.
- Software performs conversion of image data based on information theory, which leads to suppression of unwanted information in the image (noise) and signal enhancement. Software is used to improve image data to detect objects in a scene by human expert or by an automatic computer vision methods. The enhanced image is used to calculate a unique image descriptors (PIG) which is used for classifying of the image data. Unique identifier PIG can then be used for classifying image data divided into classes. A concrete example is the use of image processing of light microscopy images, which is used to classify the different stages of cell division. The input of the program is an image or series of images, and outputs is the modified image and value of PIG descriptor.
- Advantage of the software is the minimum number of parameters that must be set by the user. With one variable the user can define what part of the information in the resulting image will be suppressed or emphasized.

Graphical user interface

Testing data – BZ reaction

- BZ reaction (Belousov-Zhabotinsky reaction) The simplest "lifelike" experiment is the Belousov-Zhabotinsky reaction which is the example of self organization in a mixture of four simple chemicals Lister1995 Actually, the discovery of the chemical self-organization by Boris Pavlovich Belousov in 1959 Belousov1959 was denied by the scientific community as contradicting the second law of thermodynamics. The existence of chemical self-organization is known, but it is still not textbook knowledge. In other words, self-organization in the material world is evident, however the majority of physicochemical theories overlook it since they are unable to provide a good mathematical model for it. is The sample of the material can be prepared in a different manner. This method of preparation may affect the results of the experiment and therefore must be included in the description of the experiment and method of sample preparation.
- The reaction if photographed under controlled conditions and processed by the entropy image processing module to get entropy images and values of PIG, which represent individual images.
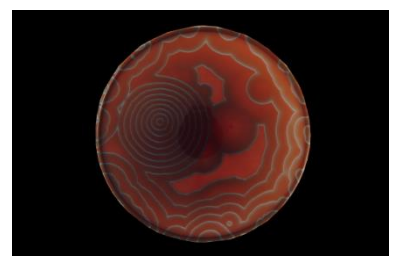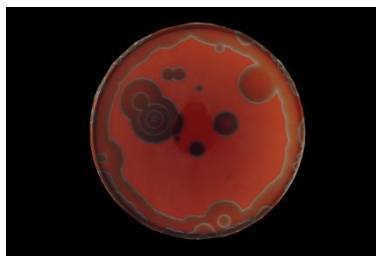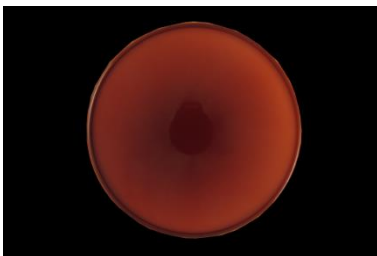
- Sample of waves created in Petri dish during BZ reaction

Testing data

- 14 different PIG for 14 different alpha values are calculated for each image
- These values are then used for classification of the wave patterns into classes
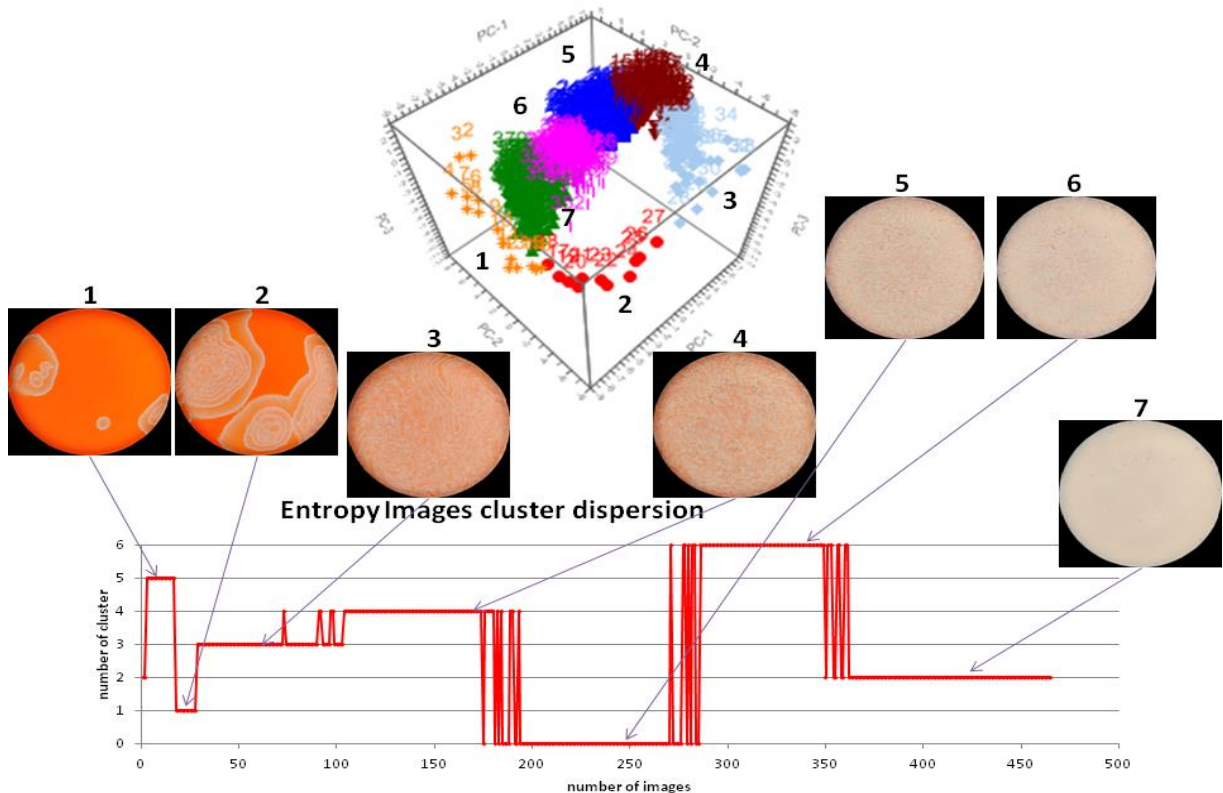
- Example of clusters based on the BZ-reaction image processing

Module testing

- Data processing
    1. Raw data in nef format are taken using digital camera and stored in the BZ reaction – raw data protocol
    2. Raw data are transformed into jpg files using LiL convertor and cropped. The area around the vessel is mask by black color
    3. Entropy calculator module is used for calculation of entropy images

- Module testing
    - Testing data and protocol are prepared under testing account at public BioWes local repository
        - Run the software Protocol Manager and log in using this credentials:
        - Login: test@test.cz
        - Password: test
        - Go to Protocols menu and select BZ example – image processing
        - Click on Entropy calculation icon in the main menu
        - Select all images from the list
        - Modify the setting of the parameters based on the image nature and purposes of processing
        - Define output directory
        - Click on run button to perform the calculation
        - Processed images will be stored in the output directory for further processing - classification