COMPSIG NITT

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Dear friends! COMPSIG NITT is a monthly newsletter to share the research work done in the Pattern recognition and computational intelligence laboratory, Department of Electronics and Communication Engineering, National Institute of Technology Trichy.

Concepts, Ideas pertaining to Computational intelligence, Pattern recognition and Signal processing are also included in this newsletter.

We expect the feedback, comments and articles from you all.

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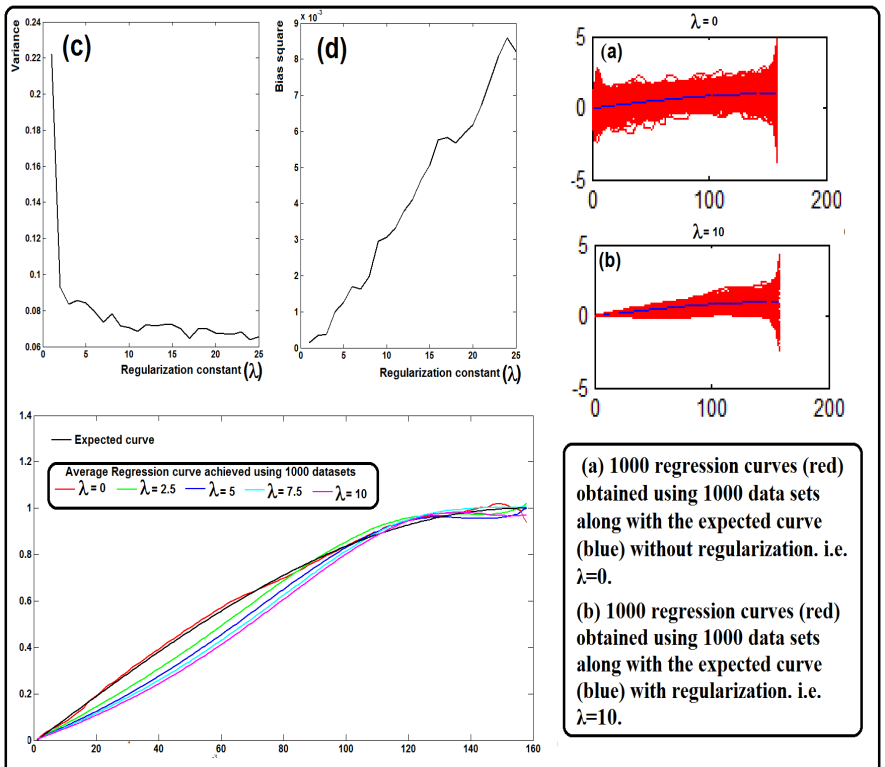
Team members

1. Dr. E.S.Gopi, Co-ordinator
2. G. Jaya Brindha, Ph.D. Scholar.
3. Neema.M, Ph.D. Scholar.
4. Rajasekharreddy Poreddy, Ph.D Scholar.
5. Florintina.C, M.Tech, Communication systems.
6. Ankur Satpute, M.Tech, Communication systems.

Illustration on the usage of regularization constant in Least square based regression

The figure demonstrates the usage of regularization constant for the minimization of the sum squared error in Least square based regression. The sum squared error after adding the regularized constant is given by $\frac{1}{2}\sum_{n=1}^{N}\left\{t_n - w^T\phi(x_n)\right\}^2 + \frac{\lambda}{2}w^Tw$ (where x_n is a data vector of length D, w is the parameter vector of length M, t_n is the target vector of length N and λ is the regularization constant).



(a) 1000 regression curves (red) obtained using 1000 data sets along with the expected curve (blue) without regularization. i.e. λ=0.

(b) 1000 regression curves (red) obtained using 1000 data sets along with the expected curve (blue) with regularization. i.e. λ=10.

(c) Demonstrates how the individual regression curve obtained using the corresponding data sets are close to each other for various regularization factors.

(d) Demonstrates how the average regression curve obtained using 1000 data sets is deviated from the expected curve.

Link to the M file used for this illustration: http://silver.nitt.edu/~esgopi/mfiles/

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Image Segmentation using Watershed Transform

The watershed transform is the method of choice for image segmentation in the field of mathematical morphology. The intuitive idea underlying this method comes from geography: it is that of a landscape or topographic relief which is flooded by water, watersheds being the divide lines of the domains of attraction. Applying watershed directly on the original image leads to over-segmentation. In order to avoid this, watershed transform is applied after some preprocessing. The preprocessing steps are as followed.

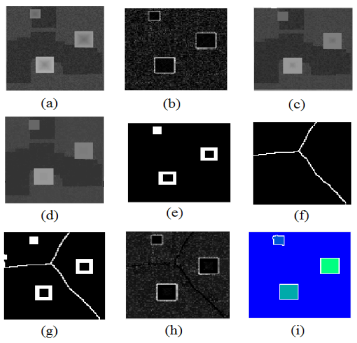

Fig.1

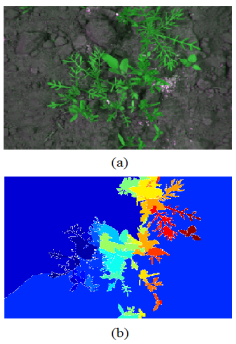

Fig.2

- Gradient of Image: The gradient of the original image [Fig. 1(a)] is obtained using the Laplacian function so as to highlight the abrupt variations which leads to edge detection. [Fig. 1(b)]
- Opening-by-Reconstruction: To smoothen the image so as to remove insignificant details, erosion is performed and this eroded image is reconstructed with the original image as mask, by clipping the intensity values of the eroded image which are greater than the corresponding intensity values in the mask to the mask level itself. [Fig. 1(c)]
- Closing-by-Reconstruction: Now to restore the image, dilation is performed with the same structural element used for erosion and the complement of the dilated image is taken and reconstructed with the complement of the image obtained from opening-by-reconstructed image. [Fig. 1(d)]
- Foreground marker identification: First regional maxima are identified as they signify the desired objects and then closing followed by erosion is performed because some times the foreground marker blobs might reach the object‘s edge. Now, the clusters which have less than a specified number of pixels are blotted out to remove some stray isolated pixels. [Fig. 1(e)]
- Background marker identification: The background markers are nothing but the boundaries which separate the different objects of interest. The processed image is converted into a binary image. Next, each pixel value is replaced with the Euclidean distance between that pixel and the nearest non-zero pixel value. To obtain clear and distinct boundaries, watershed segmentation is done on the image obtained. This image is transformed into a binary image by assigning ones along the boundary. [Fig. 1(f)]
- The Imposing the markers on the gradient image: The ORed foreground and background markers are[Fig. 1(g)] imposed on the gradient image such that the output image has regional minima only where the markers are non-zero. [Fig. 1(h)]

On this final image, watershed transform is applied [Fig. 1(i)]. This technique has been demonstrated on real time plant data set for segmenting the leaf portions as shown in Fig.2.

For further discussions contact: Ms. Florintina. C, Mr. Ankur Satpute, M.Tech Communication Systems. Mail Id:florintinachaarlas@gmail.com, ankur182709@gmail.com Back to Contents

Quotes

"Excellence is a continuous process and not an accident "
— Dr. A.P.J.Abdul Kalam

On-going research work

- Optimizing the Order of Cascaded SVM Classifier for Sunflower Seed Classification.
- Developing the methodology to Visualize the data collected from newspapers for knowledge discovery.
- Improving the classifier's result using Randomized decision rule.
- Construction of a linear discrete system in kernel space as a supervised classifier.
- Identification of crops and weeds from the field images using water segmentation followed by SVM.

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Feedback

COMPSIG NITT invites articles and innovative ideas from readers for the Reader's Space column. We expect feedback and comments to monthly newsletter COMPSIG NITT . Readers can share their views in our facebook page, "COMPSIGNITT". Those who are interested can be a part of the facebook group.
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Contact Information:
Pattern Recognition and Computational Intelligence Laboratory,
Department of Electronics and Communication Engineering,
National Institute of Technology Trichy - 620015
E-mail:esgopi@nitt.edu