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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RING HOTSPOT DETECTION

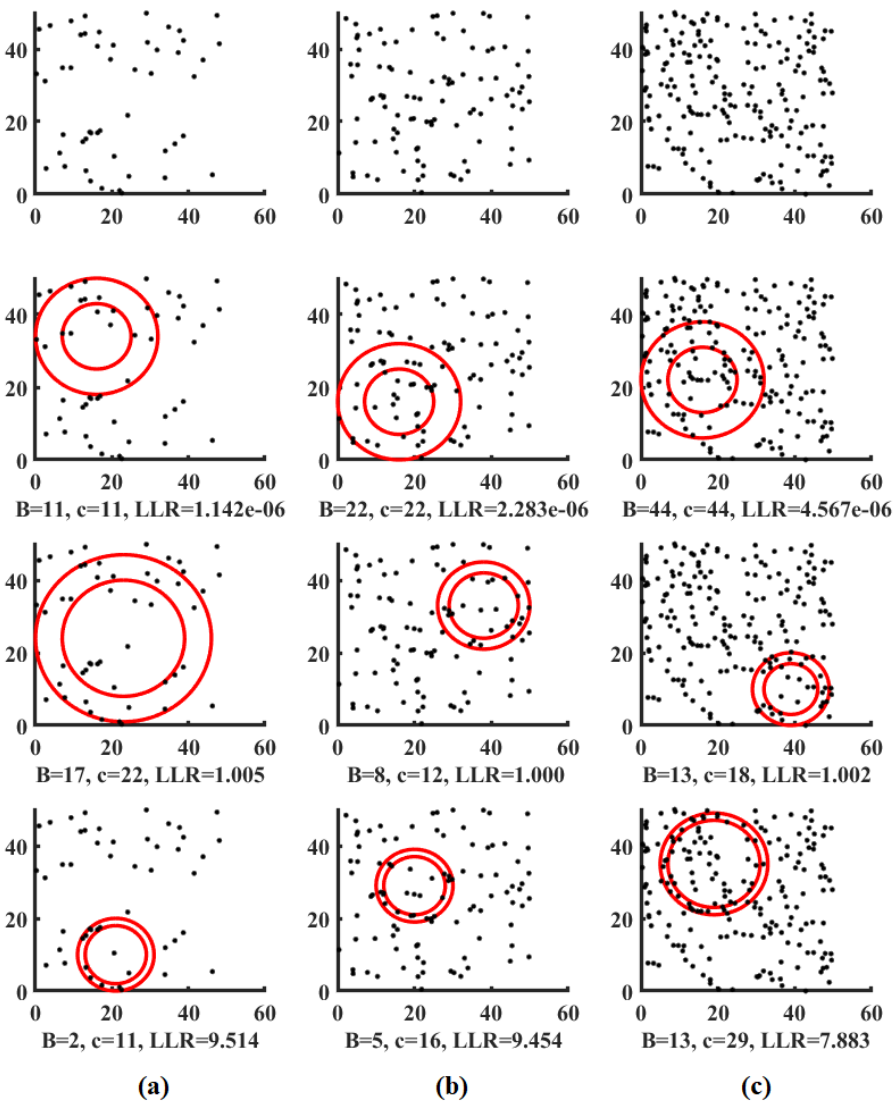

Fig. 1: Hotspot detection for different activity areas with (a) N=50, (b) N=100 and (c) N=200

Consider the two-tone image I of size 50×50 white pixels. N pixel positions (activity area) of the image are randomly chosen (uniformly distributed) and are filled with black. Now the task is to identify the best valid ring. The valid ring is the one in which the actual number of black pixels inside the ring is greater than the expected number of black pixels inside the ring. A ring is described by its center, inner radius and outer radius. Let c be the actual number of black pixels, B be the expected number of black pixels and M be the total number of pixels (area) inside the typical ring R.

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RING HOTSPOT DETECTION

As the locations of the black pixels are uniformly distributed, the expected number of black pixels inside the ring is computed as $B = \frac{N \times M}{50 \times 50}$. The occurrence of the black pixels inside the ring is considered as independent events. Let the probability of black pixel being present inside the ring R be p_b. The probability associated with the distribution of black pixels with the ring R is computed as $p_1 = (\frac{c}{N})^c(\frac{N-c}{N})^{N-c}$ and $p_0 = (\frac{B}{N})^c(\frac{N-B}{N})^{N-c}$ with $p_b = \frac{c}{N}$ and $\frac{B}{N}$ respectively. The Log Likelihood Ratio (LLR), defined as $log(\frac{p_1}{p_0})$, is computed for all valid rings, and the ring with the highest LLR value is selected as the best valid ring. Selecting the ring with the highest LLR ensures that the selected ring has the highest number of activity points when compared with the expected number of activity points within the ring. This metric is adopted in the experiment to hunt for the best ring constructed in the given two-tone image. The experiments are repeated with varying number of activity points $N = 50, 100$ and 200 and are illustrated in Fig. 1(a), (b), and (c) respectively.

It is observed that the ring in the subplot 2 of Fig. 1(a) has the minimum LLR value ($LLR = 1.14 \times 10^{-6}$) since the actual count ($c = 11$) and expected count ($B = 11$) are same and the ring in the subplot 4 of Fig. 1(a) has the maximum LLR value ($LLR = 9.51$), since the actual count ($c = 11$) is much larger than the expected count ($B = 2$). Thus, that ring is said to be the best since it has the highest LLR value among all possible rings in the activity area with $N = 50$. The B, c and LLR values are given for all rings in Fig. 1.

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Link to the m-file: Hotspot Detection

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Image Courtesy: https://theprint.in/science/pc-mahalanobis

PRCI lab commemorates the 125^{th} Birth anniversary of Prasanta Chandra Mahalanobis, the father of Indian Statistics.

Quotes

> *"Success is when your signature changes to autograph."* — Dr. A.P.J.Abdul Kalam

On-going Research

- Constructing a Sunflower plant database and perform off-type identification using deep learning techniques
- Application of machine learning techniques in next generation wireless communication
- Classification of Music composition styles using probabilistic generative model

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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, "COMPSIG-NITT". Those who are interested can be a part of the facebook group.

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