



Latest Trends on Image Segmentation Schemes

Mohd. Yasir Farooque
EC Dept.,
All Saint College of Technology,
Bhopal, India

Prof. Mohd. Sarwar Raean
HOD, EC Dept.,
All Saint College of Technology,
Bhopal, India

Abstract— *Image segmentation is a mechanism used to divide an image into multiple segments. It will make image smooth and easy to evaluate. Segmentation process also helps to find region of interest in a particular image. The main goal is to make image more simple and meaningful. Existing segmentation techniques can't satisfy all type of images. This survey addressed various image segmentation techniques, evaluates them and presents the issues related to those techniques.*

Keywords— *segmentation, image processing, clustering, partial differential equations.*

I. INTRODUCTION

One of the foremost goal of image process is to retrieve needed info from the given image in a very means that it'll not effects the opposite options of that image. De-noising/enhancement of a picture is that the most significant step needed to satisfy this demand [1]-[2]. when removing noise from a picture, you'll perform any operation thereon image [3].

Image Segmentation is one among the main steps of image process, during which any image is being divided into multiple segments. every section can represent some quite info to user within the variety of color, intensity, or texture. Hence, it's vital to isolate the boundaries of any image within the variety of its segments [4]. This method of segmentation can assign one worth to every component of a picture so as to create it straightforward to totally differentiate between different regions of any image. This totally differentiation between different segments of image is completed on the premise of 3 properties of image, i.e., color, intensity, and texture of that image. Thus the choice of any image segmentation technique is completed when observant the matter domain [5].

The importance of Image segmentation can't be neglected as a result of it issued in nearly each field of science, i.e., removing noise from a picture, medical pictures [6]-[10], satellite imaging, machine vision, pc vision, biometrics, military, Image Retrieval [11]-[12], extracting options and recognizing objects from the given image. [13]-[15]

It is discovered that there's not an ideal methodology for image segmentation, since every image has its own totally different sort. it's additionally a awfully tough task to seek out a segmentation technique for a selected variety of image. Since a technique applied to at least one image might not stay triple-crown to different variety of pictures, thus segmentation techniques has been divided into 3 varieties, i.e. segmentation techniques supported classical methodology, AI techniques, and hybrid techniques [16]. a number of the foremost celebrated image segmentation methodologies as well as Edge based segmentation, Fuzzy theory based segmentation, and Partial equation (PDE) based segmentation, Artificial Neural Network (ANN) bases segmentation, threshold based image segmentation, and Region based image segmentation are highlighted in Fig. 1. Fig. one contains vital and celebrated image segmentation techniques used for the aim of image segmentation.

II. IMAGE SEGMENTATION TECHNIQUES

Many image segmentation techniques are developed by researchers and scientists, a number of the foremost necessary and wide used image segmentation techniques are shown in Fig. 1. Latest analysis work on image segmentation techniques highlighted in Fig. one is mentioned and evaluated below.

A. Threshold based Image Segmentation

Histogram thresholding is employed to phase the given image; there's bound pre-processing and post-processing techniques needed for threshold segmentation [17]. Major thresholding techniques planned by completely different researchers are Mean technique, P-tile technique, bar chart dependent technique, Edge Maximization technique, and visual technique. during this section, many new approaches from last 5 years concerning threshold based image segmentation are being mentioned.

Salem Saleh Al-amri [18] has applied Mean technique, Pile technique, HDT, and EMT technique on 3 satellite pictures so as to pick out the major effective segmental image from all on top of techniques. Experiments and comparative analysis of techniques have shown that HDT (Histogram Dependent Technique) and EMT (Edge Maximization Technique) are the most effective thresholding techniques that surpass all alternative thresholding techniques.

Kaiping Wei dynasty [19] have found that current image segmentation techniques are time intense and need heap of machine price so as to perform image segmentation. it's an enormous drawback for real time applications. They planned a replacement threshold based segmentation technique exploitation Particle Swarm improvement (PSO) and 2-d Otsu algorithmic rule (TOPSO). TOPSO algorithmic rule used PSO technique to go looking associate best threshold for the segmentation method. They implement the planned hybrid technique on Matlab seven.0. Results shown that TOPSO algorithmic rule takes twenty five times less time as compare to ancient Otsu algorithmic rule. it's sensible for real time applications.

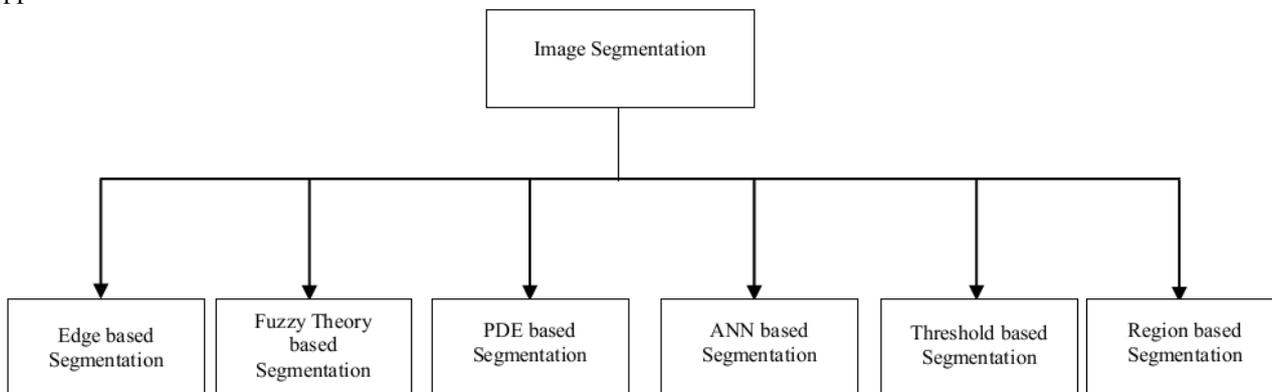


Figure 1. Varied image segmentation techniques

B. Region based Image Segmentation

Region based segmentation is easy as compare to alternative ways and additionally noise resilient. It divides a picture into completely different regions supported pre-defined criteria, i.e., color, intensity, or object. Region based segmentation ways are categorised into 3 main classes, i.e., region growing, region rending, and region merging [20].

In this section many new approaches concerning Region based image segmentation is mentioned from last 5 years. Karoui [21] planned a replacement unattended image segmentation technique exploitation level set ways and texture statistics. They claim that their technique is completely different from alternative ways since it doesn't assume experimental variable, and it doesn't prohibit to 1st order gray options.

The implementation includes feature choice step to re-adjust the weights of every feature to induce the segmentation. In experiment stage, filter response bar chart is employed to calculate the quantity of distributions; haar ripple is employed to figure the energy of image ripple of every band. PDE is employed to re-initialize the extent sets. Results have shown for a equid image as correct segmentation.

Yong-mei Zhou [22] has introduced new region-based image segmentation technique with the assistance of mean-shift agglomeration algorithmic rule. Firstly, their technique extract color, texture, and placement options of every component of a picture, secondly, build the clusters on the idea of these options exploitation mean-shift agglomeration approach, label the every region, and eventually build segments of image on the idea of those labels. They used Matlab seven.0 to implement their algorithmic rule. Experiment shows that their technique gift higher ends up in term of sped and segmentation.

Civahir Cigla [23] given a replacement graph theoretical color image segmentation technique, and tries to boost the normalized cut image segmentation technique. They used image with weighted un-directed graph, whereas nodes represent the regions, and weights between nodes represent the intensity match of neighbouring regions.

Their changed normalized cut technique has solved the matter of over segmentation during which further regions are created for image. Experiments are conducted on pictures of cow, mosaics, and multi-resolution American state image and results compared with NCIS algorithmic rule on the idea of MSE criteria. The results shown that planned technique improve the NCIS algorithmic rule.

C. Edge based Image Segmentation

Edge detection may be a basic step for image segmentation method [24]. It divides a picture into object and its background. Edge detection divides the image by perceptive the modification in intensity or pixels of a picture. grey bar chart and Gradient are 2 main ways for edge detection for image segmentation [25]. many operators are employed by edge detection technique, i.e., Classical edge detectors, zero crossing, Laplacian of Guassian(LoG)[26], and color edge detectors etc [27]. during this section many new approaches concerning Edge detection based image segmentation is mentioned from last 10 years.

Yu Xiaohan [28] planned a replacement image segmentation technique supported region growing and edge detection ways. Their hybrid technique helps the segmentation method to avoid from errors once each techniques employed in a separate manner. Region growing is employed to search out the sting pixels within the image, whereas 2ndorder by-product is employed for edge detection. Experiments are conducted on 3D tomography image information. Gaussian technique is employed for smoothing once edge detection. Results have shown that their technique is healthier so as to preserve a lot of edge data.

Wesolkowsk [29]-[30] have used the Andrei Markov Random Fields for edge and region based hybrid color image segmentation. Firstly, line method is enforced exploitation edge detection algorithmic rule. Vector angle live is employed

as a distance live between pixels so as to discover edges. the major drawback with their technique is that it's a component neighbor model and has identical drawbacks of region growing technique. A parameter estimation technique is employed to gauge the MRF model.

Ying-Tung Hsiao [31] planned a replacement image segmentation technique by combining morphological operator with region growing technique. first off they used morphological closed operation to reinforce the image then perform edge detection exploitation dilation residue edge detector. once it they deploy growing seeds and perform the region growing method for mage segmentation, after it, region merging and edge detection is performed on the pictures. They perform experiments on table game, lady and tomography image. Snake stipulation technique [32] is employed to induce higher edge detection results. All experiments are conducted in Visual C++.

Amjad Zaim [33] has found that segmentation of prostate boundaries from ultrasound pictures may be a difficult task for surgical procedures. They planned a replacement edge based segmentation technique for prostate ultrasound image. section symmetry is employed to perform the sting detection on the ultrasound pictures. Median filter is employed to cut back the noise. Edge extraction and edge linking is employed to produces the ultimate edge based segmentation image. the advantage is that their technique doesn't need any human intervention. Results of contour made by their technique are compared with manually segmental contours, and accuracy of eighty seven is found.

D. Fuzzy Theory based Image Segmentation

Fuzzy pure mathematics is employed so as to research pictures, and supply correct data from any image. Fuzzification operate will be accustomed take away noise from image also [34]. A gray-scale image will be simply remodeled into a fuzzy image by employing a fuzzification operate. completely different morphological operations will be combined with fuzzy technique to induce higher results [35]. Fuzzy k-Means and Fuzzy C-means (FCM) are wide used ways in image process [36]. during this section many new approaches of image segmentation exploitation Fuzzy theory is given.

Gour Chandra Karmakar [37] introduced a replacement fuzzy rule based image segmentation technique which might integrate the spatial relationship of the pixels. 3 forms of membership functions are used, i.e., Membership operate for Region component distribution, to live the closeness of the region, and to search out the spatial relationship among pixels. there's no got to outline parameters in their technique, like FCM algorithmic rule. Fuzzy rules uses on top of 3 membership functions and fuzzy IF-THEN rule structure to perform segmentation of a picture. FCM and planned technique is enforced on Matlab five.3.1 on X-ray image and human vocal tract image. Results have shown that GFRIS surpass FCM and isolate the item from background accurately.

Amol S. Pednekar [38] planned a replacement image segmentation technique supported fuzzy connectedness exploitation dynamic weights. Author has found that ancient segmentation schemes can't solve the issues of fuzzy medical pictures. They introduce DyW algorithmic rule that dynamically adjusts the linear weights in fuzzy connectedness. The seed DyW algorithmic rule is applied with success to the pictures of various modalities, whereas multiple seed is applied to infrared face segmentation. it's found that DyW image segmentation algorithmic rule provides ninety nine a lot of accuracy as compare to alternative techniques.

Liu Yaju [39] has planned a replacement fuzzy color image segmentation algorithmic rule supported feature divergence and fuzzy dis-similarity. Their algorithmic rule claims to boost segmentation quality. Their algorithmic rule extracts sub-images feature eagen-vector exploitation watershed technique.

Firstly, color image is remodel into grey level image, bar chart is formed in second step, cluster are created in next step, FCM is applied to every cluster, then they applied erosion, dilation, and region growing on resultant image. After it, the segmental region image is made at the tip. Image is gaga advanced background, i.e., photographic pictures. Results have shown that fuzzy approaches generate higher results.

E. ANN based Image Segmentation

In Artificial Neural Network, each somatic cell is equivalent to the component of a picture. Image is mapped to the neural network. Image within the variety of neural network is trained exploitation coaching samples, then association between neurons, i.e., pixels is found. Then the new pictures are segmental from the trained image [40]. a number of the principally used neural networks for image segmentation are Hopfield, BPNN, FFNN, MLFF, MLP, SOM, and PCNN. Segmentation of image exploitation neural network is perform in 2 steps, i.e., component classification and edge detection [41]. during this section many new approaches of ANN used for image segmentation is mentioned from last 5 years.

Xuejie Zhang [42] planned a replacement quick learning Artificial Neural Network (FLANN) based color image segmentation approach for R-G-B-S-V (i.e., RGB and HSV) cluster area. In commencement, noise is removed exploitation 3*3 averaging filter to cut back the inequality in color distribution. In second step, pixels are reborn to RGBSV area exploitation HSV conversions. FLANN agglomeration is performed to provide a cluster results of image. Next, pixels with same color are being separated.

Segment variety is allotted to every phase of image. impact of tolerance and neighbourhood size is ascertained. Results have shown that planned algorithmic rule made excellent segments for colours within the image.

Farhad Mohamad Kazemi [43] planned a quick C-means based coaching of Fuzzy Hopfield Neural network [44] so as to use it into image segmentation. Objective operate is employed supported 2-f Fuzzy HNN. This objective operate found the common distance between image pixels and cluster's centroids. per author,

Fuzzy HNN provides higher segmentation as compare to alternative ways. Firstly, they create clusters from given information, then perform normalisation, i.e. gray level pictures, calculate centroids, then figure distances, realize new

centroids, and laptop new membership operate worth exploitation fuzzy C-means [45]. The results have shown that FHNN provides a quicker speed as compare to alternative techniques of ANN.

F. PDE based Image Segmentation

PDE (Partial Differential Equations) equations or PDE models are used wide in image process, and specifically in image segmentation. They uses active contour model for segmentation purpose. Active Contour model or Snakes remodel the segmentation drawback into PDE. Some famed ways of PDE used for image segmentation are Snakes, Level-Set, and Mumford Shah technique [46]. during this section, many new approaches for image segmentation supported PDE are mentioned.

Gloria Bueno [47] presents a replacement technique of segmentation of structure in medical pictures. accommodative PDE models, i.e., fuzzy PDE Contour model, and PDE geometrical Contour model with Fuzzy C-Means classification is employed for segmentation of pictures. accommodative PDE models helped to search out the region of interest. 3D brain tomography Image is employed as a dataset. Fuzzy PDE model has phase the tomography brain image exploitation Fuzzy agglomeration approach. The model has outperformed 'Snakes' model and scale back a number of drawbacks of Snakes model.

Feature extraction schemes in [48]-[49] are capable to handling geometrical quality, rate of modification, and orientation of image. New PDE based segmentation theme is additionally given that increase distinction criteria of texture data. PDEs are used for modelling the segmentation theme. Watershed technique [50] is extended by exploitation PDE models. They compare their planned theme with watershed segmentation technique, and it's found that coupling of textural data, and modeling exploitation PDEs leads the image segmentation to prime quality method and outperforms the watershed segmentation algorithmic rule.

III. CONCLUSION

In this article, numerous techniques of image segmentation has been mentioned, an outline of all connected image segmentation techniques has been given during this paper. Recent analysis in image segmentation techniques is given during this paper. once the analysis of various techniques of image segmentation, it's discovered that a hybrid answer for image segmentation consists of 2 or additional techniques is being the most effective approach to resolve the matter of image segmentation.

REFERENCES

- [1] M. Sharif, S. Mohsin, M. J. Jamal, and M. Raza, "Illumination normalization preprocessing for face recognition,"in Proc.International Conference on Environmental Science and Information Application Technology, pp. 44-47, 2010.
- [2] M. Yasmin, M. Sharif, S. Masood, M. Raza, and S. Mohsin, "Brain image enhancement-A survey," World Applied Sciences Journal, vol. 17, pp. 1192-1204, 2012.
- [3] S. Raut, M. Raghuvanshi, R. Dharaskar, and A. Raut, "Image segmentation—A state-of-art survey for prediction,"in Proc.International Conference on Advanced Computer Control, 2009, pp. 420-424.
- [4] G. Seerha, "Review on recent image segmentation techniques,"International Journal on Computer Science and Engineering, 2009.
- [5] J. Acharya, S. Gadhiya, and K. Raviya, "Segmentation techniques for image analysis: A review," International Journal of Computer Science and Management Research, vol. 2, pp. 2278-733, 2013.
- [6] M. Hameed, M. Sharif, M. Raza, S. W. Haider, and M. Iqbal, "Framework for the comparison of classifiers for medical image segmentation with transform and moment based features,"Research Journal of Recent Sciences, vol. 2, no. 6, pp. 1-10, June 2013.
- [7] M. Yasmin, S. Mohsin, M. Sharif, M. Raza, and S. Masood, "Brain image analysis: A survey," World Applied Sciences Journal, vol. 19, pp. 1484-1494, 2012.
- [8] S. Masood, M. Sharif, M. Yasmin, M. Raza, and S. Mohsin, "Brain image compression: A brief survey," Research Journal of Applied Sciences, vol. 5, 2013.
- [9] M. Yasmin, S. Mohsin, M. Sharif, M. Raza, and S. Masood, "Brain image analysis: A survey," World Applied Sciences Journal, vol. 19, pp. 1484-1494, 2012.
- [10] M. Yasmin, M. Sharif, S. Masood, M. Raza, and S. Mohsin, "Brain image reconstruction: A short survey," World Applied Sciences Journal, vol. 19, pp. 52-62, 2012.
- [11] M. Yasmin, S. Mohsin, I. Irum, and M. Sharif, "Content based image retrieval by shape, color and relevance feedback," Life Science Journal, vol. 10, 2013.
- [12] M. Rehman, M. Iqbal, M. Sharif, and M. Raza, "Content based image retrieval: Survey," World Applied Sciences Journal, vol. 19, pp. 404-412, 2012.
- [13] M. Sharif, S. Mohsin, M. J. Jamal, M. Y. Javed, and M. Raza, "Face recognition for disguised variations using gabor feature extraction," Australian Journal of Basic and Applied Sciences, vol. 5, no. 6, pp. 1648-1656, 2011.
- [14] M. Sharif, M. Y. Javed, and S. Mohsin, "Face recognition based on facial features," Research Journal of Applied Sciences, Engineering and Technology, vol. 4, pp. 2879-2886, 2012.
- [15] S. S. Varshney, N. Rajpal, and R. Purwar, "Comparative study of image segmentation techniques and object matching using segmentation,"in Proc. International Conference on Methods and Models in Computer Science,2009, pp. 1-6.

- [16] C. Amza, "A review on neural network-based image segmentation techniques," De Montfort University, Mechanical and Manufacturing Engg., The GatewayLeicester, LE1 9BH, United Kingdom, pp. 1-23, 2012.
- [17] P. Singh, "A new approach to image segmentation," International Journal of Advanced Research in Computer Science and Software Engineering, vol. 3, no. 4, April 2013.
- [18] S. S. Al-amri and N. V. Kalyankar, "Image segmentation by using threshold techniques," Journal of Computing, vol. 2, no. 5, May 2010.
- [19] K. Wei, T. Zhang, X. Shen, and J. Liu, "An improved threshold selection algorithm based on particle swarm optimization for image segmentation,"in Proc. Third International Conference on Natural Computation, 2007, pp. 591-594.
- [20] H. G. Kaganami and Z. Beij, "Region based detection versus edge detection," IEEE Transactions on Intelligent Information Hiding and Multimedia Signal Processing, pp. 1217-1221, 2009.
- [21] I. Karoui, R. Fablet, J. Boucher, and J. Augustin, "Unsupervised region-based image segmentation using texture statistics and level-set methods,"in Proc. WISP IEEE International Symposium on Intelligent Signal Processing, 2007, pp. 1-5,2007.
- [22] Y.M. Zhou, S. Y. Jiang, and M. L. Yin, "A region-based image segmentation method with mean-shift clustering algorithm," in Proc. Fifth International Conference on Fuzzy Systems and Knowledge Discovery, 2008, pp. 366-370.
- [23] C. Cigla and A. A. Alatan, "Region-based image segmentation via graph cuts,"in Proc. 15th IEEE International Conference on Image Processing, 2008, pp. 2272-2275.
- [24] M. Sarif, M. Raza, and S. Mohsin, "Face recognition using edge information and DCT," Sindh Univ. Res. Jour. (Sci. Ser.), vol. 43, no. 2, pp. 209-214, 2011.
- [25] S. Lakshmi and D. V. Sankaranarayanan, "A study of edge detection techniques for segmentation computing approaches," IJCA Special Issue on "Computer Aided Soft Computing Techniques for Imaging and Biomedical Applications" CASCT, 2010.
- [26] M Sharif, S Mohsin, M. Y. Javed, and M. A. Ali , "Single image face recognition using laplacian of gaussian and discrete cosine transforms," Int. Arab J. Inf. Technol., vol. 9, no. 6, pp. 562-570, 2012.
- [27] B. Sumengen and B. Manjunath, "Multi-scale edge detection and image segmentation,"in Proc. European Signal Processing Conference, 2005.
- [28] X. Yu and J. Yla-Jaaski, "A new algorithm for image segmentation based on region growing and edge detection," in Proc. IEEE International Sympoisum on Circuits and Systems, pp. 516-519, 1991.
- [29] S. Wesolkowski and P. Fieguth, "A Markov random fields model for hybrid edge-and region-based color image segmentation,"in Proc. Canadian Conference on Electrical and Computer Engineering,. 2002, pp. 945-949.
- [30] M Sharif, J. H Shah, S. Mohsin, and M. Raza, "Sub-holistic hidden markov model for face recognition," Research Journal of Recent Sciences,vol. 2, no. 5, pp. 10-14, 2013.
- [31] Y.T. Hsiao, C. L. Chuang, J. A. Jiang, and C. C. Chien, "A contour based image segmentation algorithm using morphological edge detection,"in Proc. IEEE International Conference on Systems, Man and Cybernetics, 2005, pp. 2962-2967.
- [32] W. Haider, M. S. Malik, M. Raza, A. Wahab, I. A. Khan, U. Zia, J. Tanveer, and H. Bashir, "A hybrid method for edge continuity based on Pixel Neighbors Pattern Analysis (PNPA) for remote sensing satellite Images," Int'l J. of Communications, Network and System Sciences, vol. 5, pp. 624-630, 2012.
- [33] A. Zaim, "An edge-based approach for segmentation of prostate ultrasound images using phase symmetry,"in Proc. 3rd International Symposium on Communications, Control and Signal Processing, 2008, pp. 10-13.
- [34] S. Naz, H. Majeed, and H. Irshad, "Image segmentation using fuzzy clustering: A survey,"in Proc. 6th International Conference onEmerging Technologies, 2010, pp. 181-186.
- [35] I. Irum, M. Raza, and M. Sharif, "Morphological techniques for medical images: A review," Research Journal of Applied Sciences, vol. 4, 2012.
- [36] D. Hu and X. Tian, "A multi-directions algorithm for edge detection based on fuzzy mathematical morphology," in Proc. 16th International Conference on Artificial Reality and Telexistence--Workshops, 2006, pp. 361-364.
- [37] G. C. Karmakar and L. Dooley, "A generic fuzzy rule based technique for image segmentation,"in Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing, Proceedings, 2001, pp. 1577-1580.
- [38] A. S. Pednekar and I. A. Kakadiaris, "Image segmentation based on fuzzy connectedness using dynamic weights," IEEE Transactions on Image Processing, vol. 15, pp. 1555-1562, 2006.
- [39] L. Yaju, Z. Baoliang, Z. Li, L. Dongming, C. Zhenjiang, and L. Lihua, "Research on image segmentation based on fuzzy theory," in Proc. WRI World Congress on Computer Science and Information Engineering, 2009, pp. 790-794.
- [40] B. J. Zwaag, K. Slump, and L. Spaanenbunrg, "Analysis of neural networks for edge detection,"2002.
- [41] D.Suganthi and Dr. S.Purushothaman, "MRI segmentation using echo state neural network," International Journal of Image Processing, vol. 2, no. 1, 2008
- [42] X. Zhang and A. L. P. Tay, "Fast learning artificial neural network (FLANN) based color image segmentation in RGBSV cluster space,"in Proc. International Joint Conference on Neural Networks, 2007, pp. 563-568.

- [43] F. M. Kazemi, M. R. Akbarzadeh, T. S. Rahati, and H. Rajabi, "Fast image segmentation using C-means based Fuzzy Hopfield neural network," in Proc. Canadian Conference on Electrical and Computer Engineering, 2008, pp. 001855-001860.
- [44] M. Yasmin, M. Sharif, and S. Mohsin, "Neural networks in medical imaging applications: A survey," World Applied Sciences Journal, vol. 22, pp. 85-96, 2013.
- [45] W. Haider, M. Sharif, and M. Raza, "Achieving accuracy in early stage tumor identification systems based on image segmentation and 3D structure analysis," Computer Engineering and Intelligent Systems, vol. 2, pp. 96-102, 2011.
- [46] X. Jiang, R. Zhang, and S. Nie, "Image segmentation based on PDEs model: A survey", in Proc. 3rd International Conference on Bioinformatics and Biomedical Engineering, 2009, pp. 1-4.
- [47] S. Bueno, A. M. Albala, and P. Cosfas, "Fuzziness and PDE based models for the segmentation of medical image," in Proc. Nuclear Science Symposium Conference Record, IEEE, 2004, pp. 3777-3780.
- [48] A. Sofou and P. Maragos, "Generalized flooding and multicue PDE-based image segmentation," IEEE Transactions on Image Processing, vol. 17, pp. 364-376, 2008.
- [49] M. Sharif, M. Raza, S. Mohsin, and J. H. Shah, "Microscopic feature extraction method," Int. J. Advanced Networking and Applications, vol. 4, pp. 1700-1703, 2013.
- [50] A. Shahzad, M. Sharif, M. Raza, and K. Hussain, "Enhanced watershed image processing segmentation," Journal of Information & Communication Technology, vol. 2, no. 1, Spring 2008.