

SEARCHING THE ROAD NETWORK IN RURAL INDIA: A PROSPECTIVE OF RURAL DEVELOPMENT

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ABSTRACT

Connectivity in rural areas is a critical factor for social and economic development of rural population as it provides access to the amenities e.g. health, education, marketing etc. Investment in road network development in rural areas is responsible for lifting the life of rural people beyond poverty. There are evidences which provide the indication that poverty levels in rural community reduces due to proper connectivity in these areas. Roads edges are boundaries which contains the texture of different types. Edges are the discontinuities in the intensity of the image from a pixel to other. In an image, edges are very important phenomena which indicate the presence of higher frequency. The application of edge detection in an image may be used in data compression, image segmentation, and matching like image reconstruction etc.

Several methods may be used for detection of edge. Differentiation calculation of an image is the method commonly used for detection of edge. Gradient is used to compute derivative of the first order and Laplacian is used to compute the derivative of the second order. We have used the derivative of first order method for detection of roads and perform an analysis of problem domain in search of the possibility of growing further network of new roads.

Keywords: Canny's Algorithm, Data Compression, Gradient, Image Reconstruction, Image Segmentation, Laplacian, Prewitt's Algorithm, Robert's Algorithm, Rural Development, Sobel's Algorithm

I. INTRODUCTION

The development of network of roads in rural areas has several imbalances in India. There is hundred percent connectivity in some of our states but some have very bad level of connectivity due to lack of financial resources. Proper upgradation, maintenance and rehabilitation of the present road network is not performed due to lack of funds. An approach of network and sustainable accessibility provision with an assurance of maintenance is not present.

The major problems and constraints in development of connectivity in rural areas are, unpredictable and inadequate of rural road fund, insufficient funds with states, inadequate maintenance of roads in rural areas by several states, lack of maintenance of roads in rural areas, specification and quality not maintained, lack of maintenance of MDR which results the pressure on roads in rural areas, construction of roads without bridges and informal subcontracting layers which reduces quality etc.

Network of rural roads has weightage of 85% of total road network, which should be in working condition for agricultural/ rural growth, utilizing important facilities by peoples of rural areas like educational, medical and access to market.



Figure1: Distribution of Roads in India

Development of rural areas is needed for national integration, social justice, inclusive growth and economic upliftment. Network of roads in rural area is needed for their development as to enable the facilities of health centre, school and market. Lack of road access is universally accepted as an important factor of poverty continuation hence roads in rural area reduce poverty. India has 400000Km of network of roads, railway system in good condition and few ports as a result of planned development in India which was launched in 1951. Village accessibility with all weather roads was only 20%. To ensure accelerated growth, government planned a framework providing investment in power, irrigation, transport and heavy industry. Emphasis was also placed upon development of social infrastructure like health & education as well as rural development including agriculture. Network of roads in rural area provides the facilities like basic health, agricultural growth, education, opportunities related to economy and helps in reduction of poverty, achieving MDG (Millennium Development Goals), national integration, transformation related to social and economic, rural development related to holistic and inclusive, reducing isolation in communities of village. Growth related evidence reveals that well-being of poor people is improved as a result of investment in transport system. According to the study by International Food Policy Research Institute for relation between poverty and expenditure of government in rural India exhibits that 16500 people were lift above poverty line with an investment in roads worth Rs 10 Crore (@ 2009-2010 price) [Fan, Hazel and Throat, 1999]. Relation between poverty and road connectivity is also represented graphically by the data of Government of India, Ministry of Rural Development. Higher level of poverty is found in the states with low connectivity. Rural transport characteristics changes with the good roads provision. Vehicle ownership of people also increases as they tend to more travelling. The time and cost of travel reduces as shifting to motorized vehicles from non-motorized ones.

II. MATERIALS AND METHODS

Edges are formed by the boundaries of different textures. Change of intensity in image from a pixel to other may also be defined as an Edge. Higher frequency is indicated as important characteristics of the edge in an image. The application of edge detection may be applied in applications of well matching like- image reconstruction, data compression, image segmentation etc.

Different methods may be used for detection of edge. Calculation of differentiation of image is the method commonly used for edge detection. Gradient method is used to calculate derivatives of first order and Laplacian method is used to compute derivatives of second order.

Edge detection using first order derivative:

$$\nabla f = \begin{bmatrix} G_x \\ G_y \end{bmatrix} = \begin{bmatrix} \frac{\partial f}{\partial x} \\ \frac{\partial f}{\partial y} \end{bmatrix}. \quad (0.1)$$

Magnitude of this vector is an important quantity in edge detection and is denoted by $|\nabla f|$, Where

$$|\nabla f| = |\nabla f| = \sqrt{G_x^2 + G_y^2}. \quad (0.2)$$

Direction of the gradient vector is another important quantity denoted by

$$\text{angle of } \nabla f = \tan^{-1} \left(\frac{G_y}{G_x} \right) \quad (0.3)$$

Partial derivatives i.e. $\partial f/\partial x$ and $\partial f/\partial y$ at each pixel location is used to calculate the gradient of an image. If 3×3 area is representing gray level in neighborhood in an image, according to the figure. First order partial derivative at z5 point may be implemented using Roberts cross gradient operators

$$G_x = (z_9 - z_5) \quad (0.4)$$

and

$$G_y = (z_8 - z_6) \quad (0.5)$$

These derivatives can be implemented for an entire image by using the masks shown in figure with the procedure of convolution.

Another approach using masks of size 3×3 shown in figure which is given by

$$G_x = (z_7 + z_8 + z_9) - (z_1 + z_2 + z_3) \quad (0.6)$$

and

$$G_y = (z_3 + z_6 + z_9) - (z_1 + z_4 + z_7) \quad (0.7)$$

a slight variation of these two equations uses a weight of 2 in the center coefficient

$$G_x = (z_7 + 2z_8 + z_9) - (z_1 + 2z_2 + z_3) \quad (0.8)$$

$$G_y = (z_3 + z_6 + z_9) - (z_1 + z_4 + z_7) \quad (0.9)$$

A weight value of 2 is used to achieve some smoothing by giving more importance to the center point. figure, called the Sobel operators, is used to implement these two equations.

z_1	z_2	z_3
z_4	z_5	z_6
z_7	z_8	z_9

0	0	0
0	-1	0
0	0	1

0	0	0
0	0	-1
0	1	0

Figure 2: 3x3 Area of an Image

Figure 3: The Roberts Operators

-1	-1	-1
0	0	0
1	1	1

-1	0	1
-1	0	1
-1	0	1

-1	-2	-1
0	0	0
1	2	1

-1	0	1
-2	0	2
-1	0	1

Figure 4: The Prewitt Operators

Figure 5: The Sobel Operators

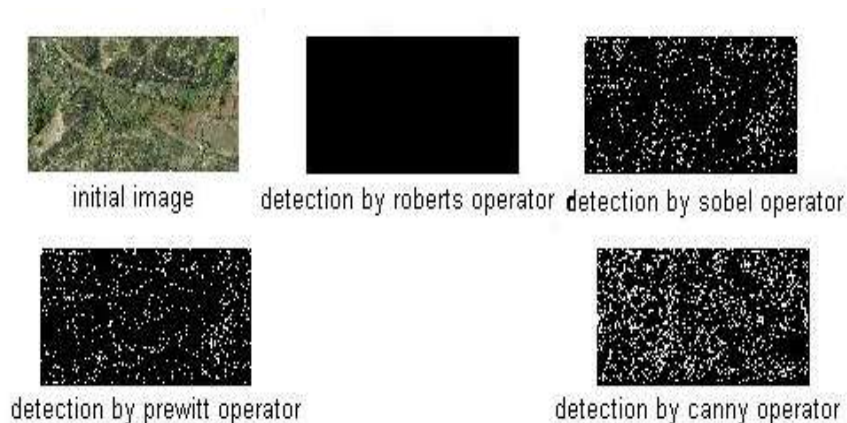


Figure 6: Results for Different Operators

III. CONCLUSION

Algorithms based on gradient like- Prewitt filter, are noise sensitive which is a major drawback. Kernel filter and their coefficient cannot be used for any image as their sizes are fixed. Algorithm of adaptive edge detection must provide a robust solution adaptable for the changing noise levels of the images as may be recognized the valid contents of the image by noise interference visual artifacts.

Canny algorithm's performance heavily depends upon standard deviation ' σ ' for Gaussian filter and threshold values ' T_1 ' and ' T_2 ', which are of adjustable nature. The size of Gaussian filter is controlled by ' σ '. The size of the Gaussian filter becomes larger for the bigger size of ' σ '. It results increased blurring, which is necessary for noisy images, and detects large edge. According to the expectation, localization of the edge is less accurate for the larger Gaussian scale. Blurring amount is reduced and finer edges in the image are maintained for smaller Gaussian filter for smaller values of ' σ '. We can adjust these algorithm by changing these parameters for adaption in different environments.

Edge detection algorithm of Canny's is more expensive, computationally, in comparison with Robert's, Prewitt and Sobel. Edge detection algorithm of Canny's has better performance than all other operators in almost all environments and scenarios.

REFERENCES

- [1]. John F. Canny, A Computational Approach to Edge Detection. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. PAMI - 8, No. 6, November, 1986.
- [2]. John F. Canny, Finding Edges and Lines in Images. M.I.T. Artificial Intelligence Lab., Cambridge, Massachusetts, Rep. AI-TR-720, 1983.
- [3]. R. W. Hamming, Digital Filters. Englewood Clis, NJ. Prentice Hall, 1983.
- [4]. Leslie Lamport, LATEX: A Document Preparation System. Addison Wesley, Massachusetts, 2nd Edition, 1994.
- [5]. U. Michael, Mathematics properties of the JPEG 2000 wavelet filters. IEEE Transactions on Image Processing, 12(9), 080-1090.
- [6]. L. Yasri, N. H. Hamid, Performance Analysis of FPGA Based Sobel Edge Detection Operator.
- [7]. Soo-Chang Pei, Jian-Jiun Ding, " Imporved Harris' Algotithm For Coner And Edge Detections", vol 1, 2005.
- [8]. William K. Pratt , "Digital Image Processing_ William K. Pratt 3rd ", chapter 15.
- [9]. Jiun-De Huang, "Image Compression by Segmentation and Boundary Description", chapter 2.
- [10]. D. Ziou& S. Tabbone, "Edge Detection Techniques An Overview", 1998.
- [11]. J. Canny, "A Computational Approach to Edge Detection," IEEE Trans. Pattern Analysis and Machine Intelligence, PAMI-8, 6, November 1986, 679-698.
- [12]. Maar, D., Hildreth E., "Theory of edge detection", Proceedings Royal Soc. London, vol. 207, 187-217, 1980
- [13]. Advanced Edge Detection Technique: Techniques in Cimputational Vision:
<http://www.cpsc.ucalgary.ca/Research/vision/501/edgedetect.pdf>
- [14]. Final Report working group on rural roads in the 12th five year plan Government of India Planning Commission Ministry of Rural Development October 2011