COMPUTER LOCATION OF DRAINAGE NETWORKS BY AN INTERACTIVE LINE FOLLOWING ALGORITHM

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An algorithm is described designed to locate and connect linear features with identical characteristics on multispectral images. The input is a map of magnitudes \( PM(i,j) \) and line orientations \( PR(i,j) \) produced by an edge and curve detection algorithm which uses a window of 5x5 pixels centered at every pixel belonging to an edge and looks for a preferred line in that pixel along 0°, 45°, 90° or 135° (\( PR=1, 2, 3, 4 \). \( PR=5 \) means indetermined orientation). Noisy results coming from the local line detection operation are avoided using a radiometric corrected input image on a combination of bands together with an appropriate threshold.

To run the algorithm the user selects a starting pixel \( k \) and gives a sign to the value \( PR_k \) to choose a direction \( D_k = 1, 2, \ldots, 8 \) for \( D_k = \pm PR_k \). The algorithm looks for the next pixel \( k+1 \) in the direction \( D_k \mod 8 \) (\( h=0, 1, 2, 3 \)) using the criteria:

1) \( PM_{k+1} = PM_k \pm \epsilon \) (being \( \epsilon \) chosen by the user) and 2) Distance \( (PM_k, PM_{k+1}) \) be a minimum. Being \( PM_k > 0 \) and \( PR_k = n \) (\( n=1, 2, 3, 4 \)) the \( k+1 \) pixel could have \( PM_{k+1} \geq 0 \) and \( PR_{k+1} = m \) (\( m=0, 1, \ldots, 5 \)) giving rise to three different cases that will be discussed. Range of neighborhood is fixed by the user in a compromise between getting good results in broken lines or a pitfall if the algorithm jumps from one chain to other.

Having the values \( PM \) and \( PR \) in memory the algorithm lasts 30 to 70 ms/pixel in the final chain (in PL/l for an IBM 360/65) depending on degree of discontinuity and number of nodes. Results obtained from LANDSAT images to locate the drainage network of the Guadarrama river in Central Spain will be presented.