Ⅱ－54 STREAM NETWORK DELINEATION BY USING THINNING ALGORITHM

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ABSTRACT: Stream lines or channel lines of the watershed are drawn by using digital elevation data. The data is formatted in common form as square regular grid and has about 250 m grid size or one-fourth of the third mesh map. The procedure of delineation is divided into three steps: the first step is to nominate the set of candidates for channel pixels, the second step is thinning the set of candidates into one-pixel-wide lines by preserving their connectedness and the third step is to cut isolated pixels, unrequired channels and extending isolated lines until join the downstream links.

1.INTRODUCTION

In field of hydrology, channel network and drainage direction are used widely, especially, for distributed runoff models which require spatial variation of various model parameters. Since digital gridded elevation data has been developed as data base of the basin, many methods have been proposed to detect the channel network by using such data. In this paper, digital image processing technique is applied to delineate channel lines of the watershed.

2.THINNING ALGORITHM

The thinning algorithm used here is similar to the one that described by Rosenfeld and Kak (1982), the procedure is established for a 3 x 3 local-parallel to detect the medial line, one-pixel-wide line, of thick picture by deletion the border points of that picture iteratively and the deletion does not locally disconnect their neighborhoods. The connectedness of picture pixels(=1) and background(=0) are considered in 8 and 4 directions respectively. The border points for deletion are classified into 4 types - north, south, east and west which their north, south, east and west neighbors are background pixels respectively.

The definitions of connectedness for three points A, B and C and used to supplement the deletion conditions can be presented as follow: A is connected to A; if A is connected to B then B is connected to A and if A is connected to B and B is connected to C then A is connected to C.

P_4	P_3	P_2
P_5	P_0	P_1
P_6	P_7	P_8

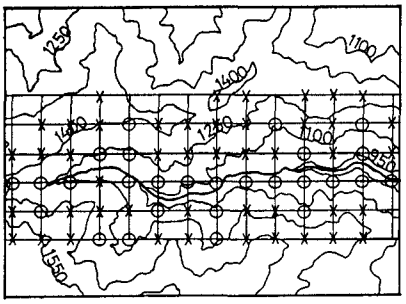
Fig.1 3 x 3 window system

3.METHODOLOGY

Step 1: Pixel nomination for channel

This procedure to find candidate pixels for channel lines and go like this, the elevation of considering point P_0 and its 3 neighbors P_1, P_7 and P_8 will be intercompared, the highest one is marked as not candidate. The procedure scans over each four pixels sequentially until the scanning is completed cover whole matrix of data, unmarked pixels are considered as candidates for channels. This concept can be

explained by picture in Fig.2.



O candidate pixel
X not candidate

Fig.2 Concept of pixel nomination for channel

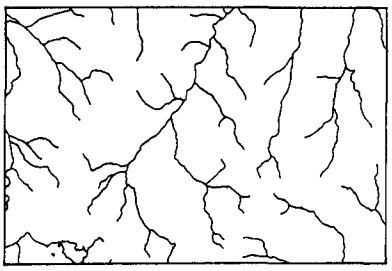


Fig.3 Channel system of watershed(one part)

After the concept mentioned above was applied to the watershed in Fig.3, one part of the result is shown in Fig.4.

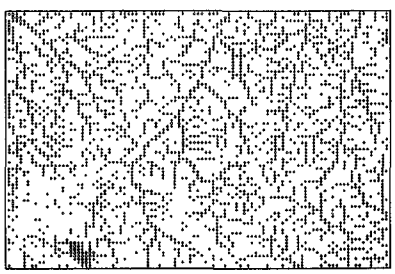


Fig.4 Pixel nomination

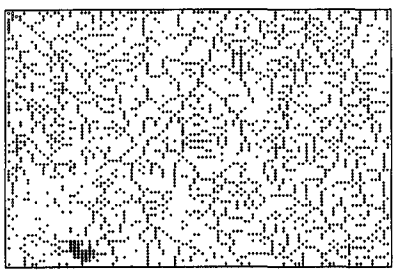


Fig.5 Channel line thinning

STEP 2: Channel line thinning

The algorithm explained in section 2 was applied to thin the picture obtained from step 1 to be one-pixel-wide lines and preserving their connectedness, in order to keep the thinned lines at middle, each iteration of deletion border points is divided into 4 subcycles and each subcycle deletes only north, south, east and west border points respectively. The result of thinning is shown in Fig.5

STEP 3: Channel decoration

The result obtained from step 2 was decorated by cutting unneccessary lines, isolated points and unconnected channel lines were extended to join the downstream channels.

4.CONCLUSION

This concept for channel network seem to be easier but some watersheds, particularly, studying one plenty of pixels are nominated for channels,so, cutting unrequired channels must be carried on carefully.

5.REFERENCE

Rosenfeld, A. and Kak, A., Digital Picture Processing, 2nd ed., vol.2, Academic Press, Orlando, Fla., 1982.