

A Study on the Preprocessing Method Using Construction of Watershed for Character Image segmentation

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Abstract: Off-line handwritten character recognition is in difficulty of incomplete preprocessing because it has not dynamic and timing information besides has various handwriting, extreme overlap of the consonant and vowel and many error image of stroke. Consequently off-line handwritten character recognition needs to study about preprocessing of various methods such as binarization and thinning. This paper considers running time of watershed algorithm and the quality of resulting image as preprocessing. For off-line handwritten Korean character recognition. So it proposes application of effective watershed algorithm for segmentation of character region and background region in gray level character image and segmentation function for binarization image and segmentation function for binarization by extracted watershed image. Besides it proposes thinning methods which effectively extracts skeleton through conditional test mask considering running time and quality. of skeleton, estimates efficiency of existing methods and this paper's methods as running time and quality. Watershed image conversion uses prewitt operator for gradient image conversion, extracts local minima considering 8-neighborhood pixel. And methods by using difference of mean value is used in region merging step, Converted watershed image by means of this methods separates effectively character region and background region applying to segmentation function. Average execution time on the previous method was 2.16 second and on this paper method was 1.72 second. We prove that this paper's method removed noise effectively with overlap stroke as compared with the previous method.

Keyword: Watershed Algorithm, Preprocessing Process, Handwritten Character Recognition, Binarization Thinning

1. INTRODUCTION.

Preprocessing of the back whom Contour is extracted from time or off line handwritten Korean character recognition lost space information, or extract Skeleton from data got by an input device is needed. Therefore, handwritten Korean character of various forms has the trouble that had to carry out incomplete Preprocessing accompanied by a loss and distortion of a lot of information by a lot of error image and distortions to be able to be included in input character. Off line handwritten Korean character recognition extracts the stroke which Korean character is composed of in order handwritten Korean character being enormous and variety of handwriting, a similar castle between characters are high, and to extract dynamic information of character, and the way that a pattern between stroke is analyzed, and recognition does is achieving the mainstream. The quality is large,

and an extraction of Stroke for recognition differs according to binarization and performance of a thinning. Therefore, as for the handwritten character recognition prospective according to performance of a preprocessing process and an elevation of a quality in quality. Off line handwritten Korean character recognition covers it, and preprocessing performance and a lot of treatises about a quality improvement are constantly published, but I am by study yet, and approach of various ways does need.

Because off line handwritten Korean character covers it, and an error image component is removed suitably, a lot of degree of difficulty a hard thing is had, and to separate character scope and background scope is asked. Watershed algorithm had a characteristic and a characteristic of the image segmentation which used similar with adjacency scope to deal with error image of an image effectively, and it was applied to an image elevation and image

segmentation of a character image. An off line handwritten character image elevation and the segmentation function that binarization did a Watershed application way effective in it for image segmentation and an extracted watershed image with character scope and a background component and the thinning way that used a condition check mask were proposed in this paper. Performance is evaluated with accomplishment time and a quality with the existing way and this paper way. The application way that a disadvantage of an accomplishment speed decrease was considered by excessive segmentation and was at each application level of watershed algorithm, and was suitable for handwritten Korean character of a watershed algorithm application image was evaluated, and was composed. As for the configuration of watershed algorithm for the character image segmentation which execution time, a quality of results image were considered, and proposed it in this paper for segmentation of character scope and background scope in gray level character image, following. First of all a Prewitt slant operator is used, and a gradient image conversion is carried out, and a 8-neighborhood direction pixel is considered, and a local minimum point is extracted. And the segmentation function that statistical probability numerical value is used, and binarization does the watershed image that a scope segmentation level is passed through, and a car of an average is used, and a scope absorption is carried out, and a conversion became is applied, and background scope and character scope are separated effectively. Extract the skeleton which was suitable because is with character recognition through the thinning which used a condition check mask to character scope to be different too and extracts stroke.

2. CONFIGURATION OF WETERSHED ALGORITHM FOR CHARACTER IMAGE DIVISION.

Be composed with four phases like overall configuration of the watershed conversion that applied to an off line handwritten character image in this paper (picture 1).

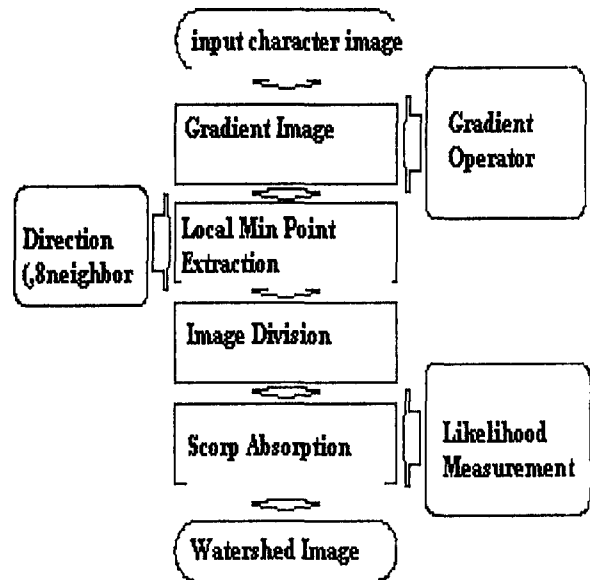
1 step converts a circular pictorial image into the gradient Image which had altitude.

2 step extracts pixels to have had local minima from an inclined image.

3 step carries out flooding with high altitude in local minima, and segmentation does similar scope.

The last 4 step extracts a watershed image with carrying out region merging about similar scope.

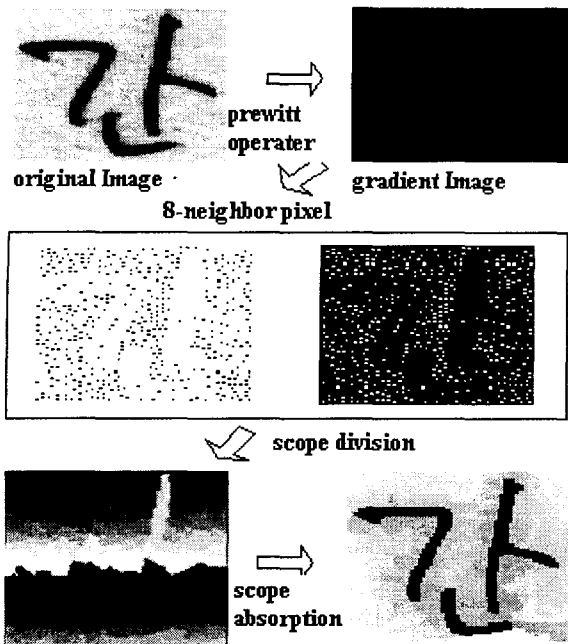
Watershed was composed with a way experimentation about the ways that generally was used in each level so that the watershed algorithm that was suitable for character scope segmentation of a handwritten Korean character image was composed and was carried out, and to have good performance in each level with execution speed and a quality of results image.



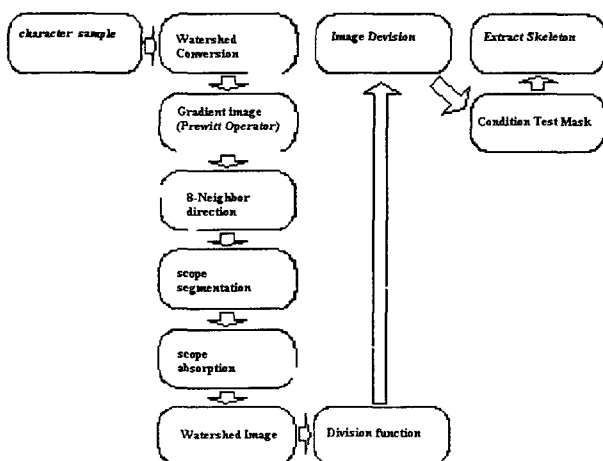
(Picture 1) A wetershed conversion formation table

An example applied to a character image for character image segmentation to this paper (picture 2) was shown in.

Watershed algorithm was composed with the way that an execution speed and a quality of results image were considered in each level that watershed algorithm was composed of experimentally, and was the most suitable for handwritten Korean character image segmentation. First of all a prewitt gradient opera or was used, and a conversion was carried out in an inclination of 0, and a 8-neighborhood direction pixel was considered, and a local minimum point was searched for.



(Picture 2) a watershed conversion to have applied to a character image

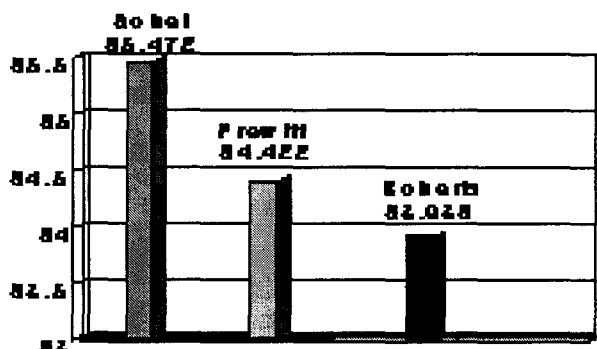


(Picture 3) an overall preprocessing system formation table of this paper.

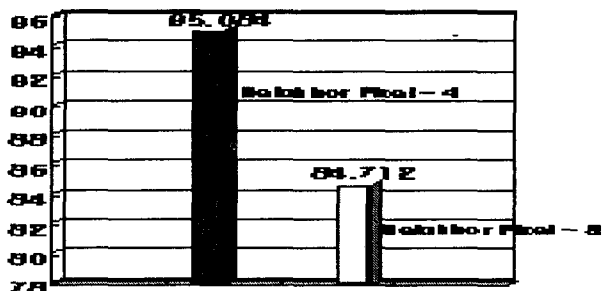
3. THE EXPERIMENTATION RESULTS AND AN EXAMINATION.

Comparison evaluated execution time based on an application way in watershed algorithm each step in experimentation. Also, comparison evaluated execution time and a quality of results image through the way that image segmentation covered it, and was offered in the existing ways and this paper. A quality of execution time and skeleton of a thinning way and the existing way used for this paper was evaluated. 100 samples were selected, and the sample used for experimentation used it with any ranking in each level among handwritten character data by the 520th Korean

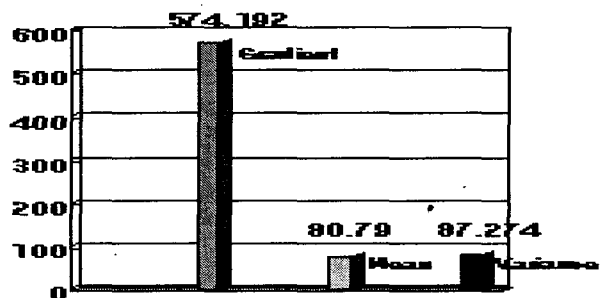
handwritten data bass sample middle high rank included by Korea National Language Information Base CD-ROM made in KAIST. A sample is composed of a brightness pictorial image of 100*100. The execution time that execution time measures it in a unit for one second of 100, and obeyed an application way in each step of watershed algorithm is evaluated. Execution time and a quality to have been based on the existing way and a way of this paper are evaluated in an image segmentation process and a thinning process. Calculate time in an average of several lines punishment party councils that is the last on an overall preprocessing process, and total execution time and character of handwritten character data did by the 520th high rank of the existing way and a way of this paper, and evaluate it.



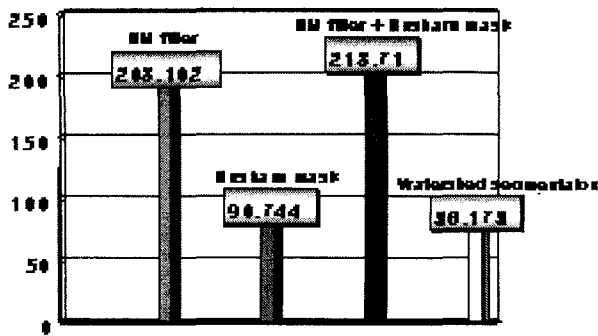
(picture 4) an average of execution time that followed a gradient operator



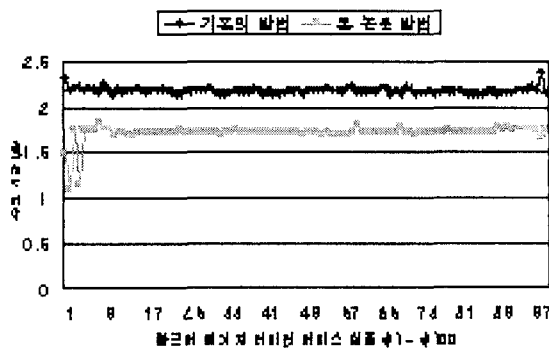
(picture 5) the average execution time which was based on a neighbor direction pixel



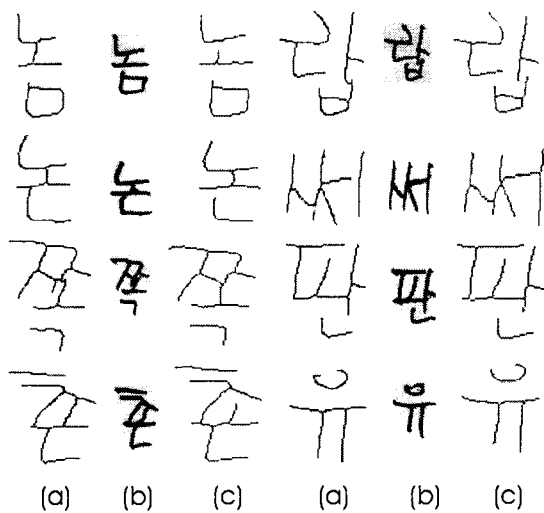
(picture 6) the average execution time that was based on a likelihood measurement way



(picture 7) image division average execution time



(picture 8) an preprocessing execution time graph (sample 1-100 address)



(a)existing way (b) original Image (c) a way of this paper (picture 9) preprocessing results image

As a result of having applied the existing way and a way of this paper to a circular image, the preprocessing results image looked in an image (picture 9). Because time was 1.72 sec, a way of this paper was with an average of several lines ways of the paper that I had a lot in common in the preprocessing execution results, and time read 2.16 sec, in an average of several lines existing ways in execution time, and an evaluation became a fast thing. If there is not a contact of stroke in a quality evaluation about the

preprocessing execution results, the existing way and a way of this paper show you the all good results. But a way of this paper showed you the good results when a contact of stroke and a degree of error image were severe. (in picture 9) the existing way extracts a skeleton with connection stroke, but a contact of stroke disconnects stroke in case of this paper way in case of occurrence effectively. Also, the skeleton which had pixel thickness for a characteristic point extraction if possible was extracted from stroke extraction level. The good results were displayed in a skeleton extraction to store a pattern and a connectivity of a pattern background. But several problems looked, t.o. If there was too a few it, and scope segmentation of a watershed image consisted in an end point during an image segmentation process, the problem that can not consist effectively occurred, and an operation of a segmentation function showed you a lot of erosion results. And have a lot of it in the notes section which is last with a characteristic of Korean notes in case of vowel sound " " what shed worked, and a brightness difference with a surrounding pixel occurred if was built, and a connection was disconnected. A case as above occurred in the existing way, and a Mean filter ring was not used in this existing way, and solution can be done at the time of Unsharp mask processing, but the results that were not good were brought into a sensitive problem in error image.

4. A CONCLUSION AND AN ASSIGNMENT NEXT

It is severe to shed, and, as for the off line handwritten Korean character recognition, an error image component is existing in variety and end line of handwriting very much. Also, a contact of character element occurs very much unevenly and is with recognition, and degree of difficulty is high, and it can be done. The trouble that must carry out the preprocessing which is incomplete too is had. The paper to have seen in this incomplete preprocessing absorbed an error image component with what the watershed algorithm that was suitable for a handwritten character image was composed, and was applied effectively, and a segmentation function was used, and character scope and background scope were separated effectively. Also, an execution speed of a preprocessing process and superiority of a quality of results image were shown you with the thinning way that used a condition check mask. An average of several lines time of this paper way was 1.72sec, and a profit of execution time was seen than the existing way of 2.16sec. Were especially on a contact part between

stroke, and thickness of a pixel, a process of end line got the good results with a maintenance of a circular pattern in a skeleton quality evaluation of results image if possible. However, a lot of improvement matters are necessary for degree of difficulty dealing with high off line handwritten Korean character. A segmentation function was applied for effective image segmentation in a watershed image during the way that proposed it, and the most suitable threshold effective in it is raised in this segmentation function, and a lot of researchers about a setting way are necessary. Also, a lot of researchers are necessary in local at least point setting which considered a handwritten Korean character characteristic in watershed algorithm well and scope segmentation and scope absorption step.

Segmentation of the character element which is a trouble of handwritten character covers this study, and the good results are expected.

Also, the thinning way that considered a stroke contact must be done at the same time.

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