USING ARTIFICIAL NEURAL NETWORKS FOR AUTOMATED EDGE EXTRACTING FROM AERIAL IMAGES

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Abstract

Ortophotos, obtained by processing aerial images via photogrammetrical methods, are main data of the raster based Geographical Information Systems (GISs). Usually, these systems don't represent all relations according to pixel-to-pixel matching between raster database and nongraphic database. Due to the this practical reason, one surjective mapping can be mentioned between raster database and nongraphic database. This mean, set-oriented languages can interrogate only topologically related objects in GIS databases. But this approach is restricting the high-level querying of the raster database. Automatic raster query tool development studies are exploded in last five years. Artificial image processors development studies are improved the neuro-query named raster database automatic-query tools. The main aim of this study is investigating the possibilities of aerial image enhancement and automatic edge extracting from aerial images in one-step for save time and gain query power for surveying and informatic studies on raster databases.

1. PARALEL FILTERING

The primary aim of digital image processing is enhancement of images for extract desired information.

Filtering is a useful tool for image enhancement. Because of artificial neural networks (ANNs) has parallel structure, its possible to apply on to images in same time domain more then one filter. Filtering images, in same time domain, by more than one filter is called parallel-filtering.

2. ARTIFICIAL NEURAL NETs

There is enough information exist about ANNs in literature. Therefore, only the general characteristics of ANNs are mentioned at bellow. ANNs are,

1. Learning from experience
2. Generalising from experience,
3. Extracting essential information from noisy data,
4. Developing solutions faster and with reliance on domain expertise,
5. Adaptable
6. Compute efficently and,
7. Non-Linearity

3. RESULTS and APPLICATIONS

Digital images has been used during the training process of the backpropagation based ANN. The test and query images are given at the appendix.

The first application on paraller-filtering of aerial images with ANNs is an enhagement process. This process include both an unbluring filtering and an contrast stretching phase. Blured aerial image is represented at figure 1 and contrast stretched and unblured image illustrated at figure 2, respectively. Figure 1 represents both training and query data sets. The white bounded square, at the left-top of the figure 2, is covers the training set and except of this square figure 2 represents the query (or test) data set.

An backpropagation algorithm, Extended Delta Bar Delta (EDBD), training rule is used during the all training phase in first application. The EDBD learning algorithm's details are expressed at [10].

The EDBD learning rule includes a little-used "error recovery" feature which calculates the global error of the current epoch during training. If the error measured during the current epoch is greater than the error of the previous epoch, then the network's weights revert back to the last weight set (the weights which produced the better error measure).

In the second application ANNs extracted edges from photogrammetric images after histogram equalization algorithm.

Both of applications are realized least two image enhancement procedure in one step. This

applications shows that its possible to enhance images with ANNs and its possible to design parallelly image enhancement filters by ANNs, respectively.

4. APPENDIX

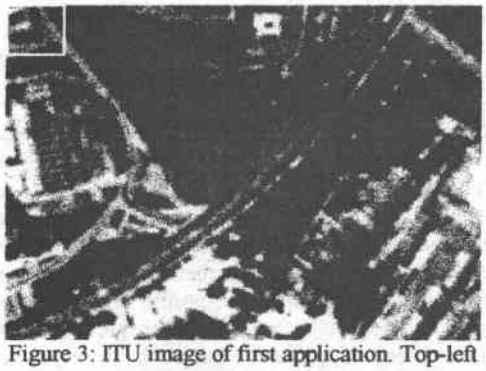

Figure 3: ITU image of first application. Top-left part is used for training and recall of ANN.

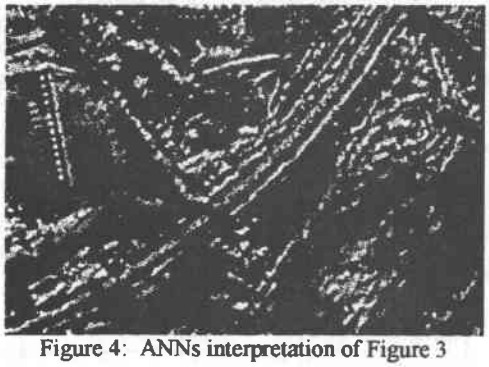

Figure 4: ANNs interpretation of Figure 3

ANNs architecture of application 1.
Scaled-RMS 0.0099 Correlation 0.9978
Iteration 1.465.200 [49x10x10x1]
Backpropagation-EDBD

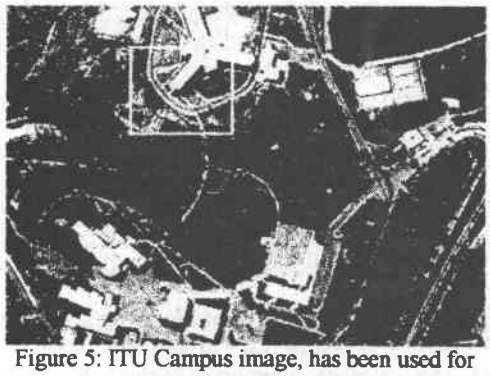

Figure 5: ITU Campus image, has been used for second application.

Bounded with white square part is used for training and recall of ANN.

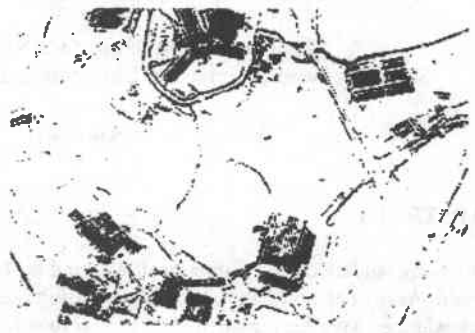

Figure 6: ANNs interpretation of Figure 5

ANNs architecture of application 2.
Scaled-RMS:0.0014 Correlation 0.9999
Iteration 46.800.000
[49x10x10x1] Backpropagation EDBD

5. REFERENCES

1. National Technology Information Service USA-WL-TR-91-1146 ,1992

2. Artificial Neural Networks, Schalkoff,R.J.,McGraw-Hill Press, ISBN 0-07-057118-X,1997

3. Fuzzy Sets and Fuzzy Logic, Yuan,B.,Klir,G.,J.,Prentece Hall,1995, ISBN 0-13-101171-5

4. Neural Network Design,Beale,H.,D., PWS press,ITU 61332

5. Sayısal İşaret İşleme,Kayran,A.,H.,ITU,1990

6. Image Processing and Machine Vision, Sonka,M.,Hlavac,V.,Boyle,R.,1999,ISBN 0.534.95393.X

7. Computer Vision and Image Processing, Umbaugh,S.,E.,,1998,ISBN 0.13.790882.2

8. Photogrammetry, Kraus,K., 1997, ISBN 3.427.78694.3

9. Digital Image Processing, Prat,.W.,K.,1991 ISBN 0.471.85766.1

10. NeuralWorks Professional II/PLUS Supplement version 5.3, 1997, page 40.