EXPERIMENTAL STUDY ON MERGING METHODS IN ROAD RECOGNITION

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Abstract: *In this paper we will speak over the existing various methods for merging the remotely sensed images. The final goal is to achieve and determine the suitable method for precise data integration with a multi-source nature. In general, the process of image merging methods is meant to integrate the data, which is transmitted by data with various spatial and spectral resolutions either with an aerial, or with a satellite platform. Mainly, the aims are the proper image analysis, as well as the performance of technical assignments. Such assignments are deduction of features, classification and segmentation as the biggest advantages of the fusion technique.*

ЕКСПЕРИМЕНТАЛНО ИЗСЛЕДВАНЕ ВЪРХУ МЕТОДИТЕ ЗА СЪВМЕСТЯВАНЕ НА ДАННИ ПРИ РАЗПОЗНАВАНЕ НА ПЪТИЩА

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Резюме: *В тази работа ще говорим за съществуващите различни методи за сливане на изображения, получени при дистанционни изследвания. Крайната цел е да се постигне и определи подходящият метод за точна интеграция на данните от много източници. По принцип процесът на сливане на изображения има за цел да интегрира данните, които се предават чрез данни с различна пространствена и спектрална разделителна способност, получени от аеро- или спътникови платформи. Основно целите са правилният анализ на изображението и изпълнението на технически задачи. Такива задачи са намаляване на броя на характеристиките, класификация и сегментиране като най-голямо предимство е самото съвместяване.*

Introduction

The information merging is determined as a combination between the different sources of information and the whole process of it. This is important for accurate measurements that are accurate with only one source. Achieving the highest punctuality in all the data settings in accordance to the conclusions is the main aim. Conversely, integrating information maximizes data settings by merging different sources [1]. Be aware that data merging process has been used in several spheres such as health services, robotics, military fields, Bayesian fusion, Voting Logic, Fuzzy Neural Networks, Dempster-Shafer theory, Artificial Neural Networks and Fuzzy Logic. The listed approaches are suitable for usage in a different step of the process. Plus – they can collaborate with each other in various ways in order to turn out brand new methods for merging.

Mena and Malpica [2] most often practice the merging data process. In connection with this there are three classifiers and each of them gets a single per pixel pseudo-probability value in the range [0–1]. Each classifier gets a concrete image named RGB IKONOS. In an addition to this, a road

for model is inserted. The extra overtime application of the merging process in the road network, when it comes to extraction systems, is handled by Gerke [3]. He actually offers a special model that measures the quality and permits each object to be priced immediately.

Meantime, the available Geographic Information System (GIS) road information is generally appraised against roads excerpted from latest aerial pictures via an automotive technique. This automotive technique is able to excerpt multitudinous, but not one single road element to one data road element. Putting the quality metric after each excerpted element and data element will eventually conduct to several ways of measurements. Afterward, this should become a mixture with one kind of measurement.

In the literature it is known many other data fusion ways. Most of researches have applied easier merging approaches such as the examples – rule-based logic [4], superimposition [5], and mathematical morphology [6]. When it comes to choosing a particular approach to merger, what is the number and type of data that need to be considered.

Merging the data examined the way in which the final results of the specified classifiers interact. The classification process is done using the exact segmentation method. In many cases, the classification can remain as before segmentation method of low level image processing.

Image merging techniques

1. Dempster-Shafer fusion

DST is known as the theory of proving. This is connected with the cooperation of several different elements of the empirical evidence on purpose to get an accurate picture of real life. DST lies upon the measurement of the non-objective possibilities and opinions functions by Shafer [7]. Also, it includes the Dempster [8] principle for collaboration. Schafer's approach is actually a summary of the Bayesian approach to obtaining degrees of views. On the other hand, Dempster approach is focusing on different posts in a single evaluation. They may differ in the degree of possibility of any opinion. DST supposes consideration, while Bayesian prefers the ordinary belief in a question. We are about to put under consideration the DST execution. Let's start with the different characteristics of the beliefs of Schaffer and then continue with Dempster's collaborative principle.

The merger of Dempster and Shafer is applied for collaboration of all the results that are gained by the classifiers. Meantime, the approach of the merger requires incredible value for all classifiers and core value for each pixel. The untrustworthy value is significant for the stage of certainty that each of the classifiers stores in its main categories. In addition, you can calculate the unreliable value by looking at the possibility that the classifier categorically categorizes the road model. Pseudo-potential value calculated for each pixel, is given as a common value. The merger process performs the fidelity value again for each pixel. This allows for clearing the pixels belonging to a particular classifier type way. There may be more than one classification of the road or the other scientific or engineering application.

In a narrow sense, the term Dempster–Shafer theory, which is the base of the fusion, is strongly related to the original conception of the theory by Dempster and Shafer. Nevertheless, it is more common to use the term in the wider sense of the same general approach, as adapted to specific kinds of situations which can be very broadly spread in many scientific applications, integrated in some processes and engineering aims and purposes.

2. Fuzzy logic in the process of images

The process of fuzzy image is not the original theory. As a matter of fact, it is the complex of all the methods that depict, show and perform the images, as well as their elements and properties as fuzzy settings. The depiction and the performance are dependent on the chosen fuzzy approach, as well as on the issue that should be resolved. In recent years, many fusion techniques have been proposed by various researchers in different areas of application in science. The process is composed of three main steps that have to be followed as deducted:

• Fuzzy image processing (Applying the features of the membership in order to depict the condition in a graphic stage).

• Changing the membership indicators (Usage of Fuzzy principles).

• Fuzzy image de-processing (Getting the slices or the punctual results).

The codes of the image information (the fuzzy-image processing) and the decoding numbers of the gained results (fuzzy image de-processing) are stages, which are important for the fuzzy image process. The most important thing about the process of fuzzy image is, in fact, domestic media phase - change indicators for membership. Once the image information is turned from the plane of a grey-level feature to a complete plane for membership (the exact fuzzy image process), the suitable fuzzy approaches change the membership indicators.

Generally people decide to do something according to principles while fuzzy techniques that are designed to mimic the mannerisms of the person doing the same. At the same time, the whole decision-making process is changing and fuzzy settings are instead set. There are also fuzzy principles. Fuzzy principles act by applying numerous opinions with the if-then structure. Here is an example – if A then B, if C then D. B and D are settings of A and C. Fuzzy principles depict the fuzzy pieces and this is the most important thing about the entire fuzzy process.

Fuzzy Inference System (FIS) is actually a process with these elements:

• A complex of inserted features for inserting the features of the membership.

• Inserted features of the membership regarding the principles.

• Initial membership functions to once evaluate initial index.

Also, FIS has these restrictions:

• The features of the membership are clearly named and in some cases they are random.

• Fuzzy Inference is used for creating a system, where all the principles are predestined in exact numbers regarding the consumer`s own opinion.

The shape of the elements of membership may be replaced with replacement indicators for elements of the membership. However, in this case the parameters are important. When FIS is regular, the indicators are random and selected information at the moment. If you want to use fuzzy principle in the process where there is whole complex internal-external information, there is no predetermined set of parameters. In some cases, however, when the parameters are random, it will not be enough to create the system by a specially selected method. In this case, the random choice should be replaced with the adjusting feature of the parameters that could be based on the inserted information types. Thus, the Neuro-based learning approaches might become parts of the FIS.

The special thing about the fuzzy approach is due to the fact that people`s ways of thinking are very dependant and close to the reality. When ordering, discovering cause and effect and quantifying data assists and structures understanding a human express mathematical and logical way of thinking. The sense of the reality is very narrow in understanding as the fuzzy way of implementation of fusion image processing.

The most important characteristics of the fuzzy approach by Zader Lotfi are the following ones:

• It is always about the particular level.

• You can fuzzify all kinds of systems.

• The information is understood as a complex of flexible or approximately changeable variables.

• Conclusion is a process that propagates all the elastic constrains.

The purpose behind fuzzy logic was to describe the great features of fuzzy settings. This is important for the processing of images. The highlights of the process are as follows:

• Fuzzy settings show the three-dimensional data of the image, as well as its inaccuracy.

• The management of three-dimensional data is realized by the fuzzy settings and data merger applying the fuzzy collaborative operators.

• Quick calculation with the fuzzy numbers from the operation.

3. Neuro-fuzzy approach for an image merger

The network, where the experimental information is stored and where the data tests are performed is called Neural Network. On the other hand, the Neuro-Fuzzy is a complex of fuzzy approach and neural network, which is not real, but artificial. Applying this technique, people can transform the system in accordance with the input dataset and output data required. In this way the system can be defined as a set of entries.

Neuro-fuzzy system is a system that is processed by a neural network studying algorithms. Because of this process, the indicators change immediately on their own. The execution of the Neuro-Fuzzy approach is performed thanks to the Adaptive Neural Fuzzy Inference System.

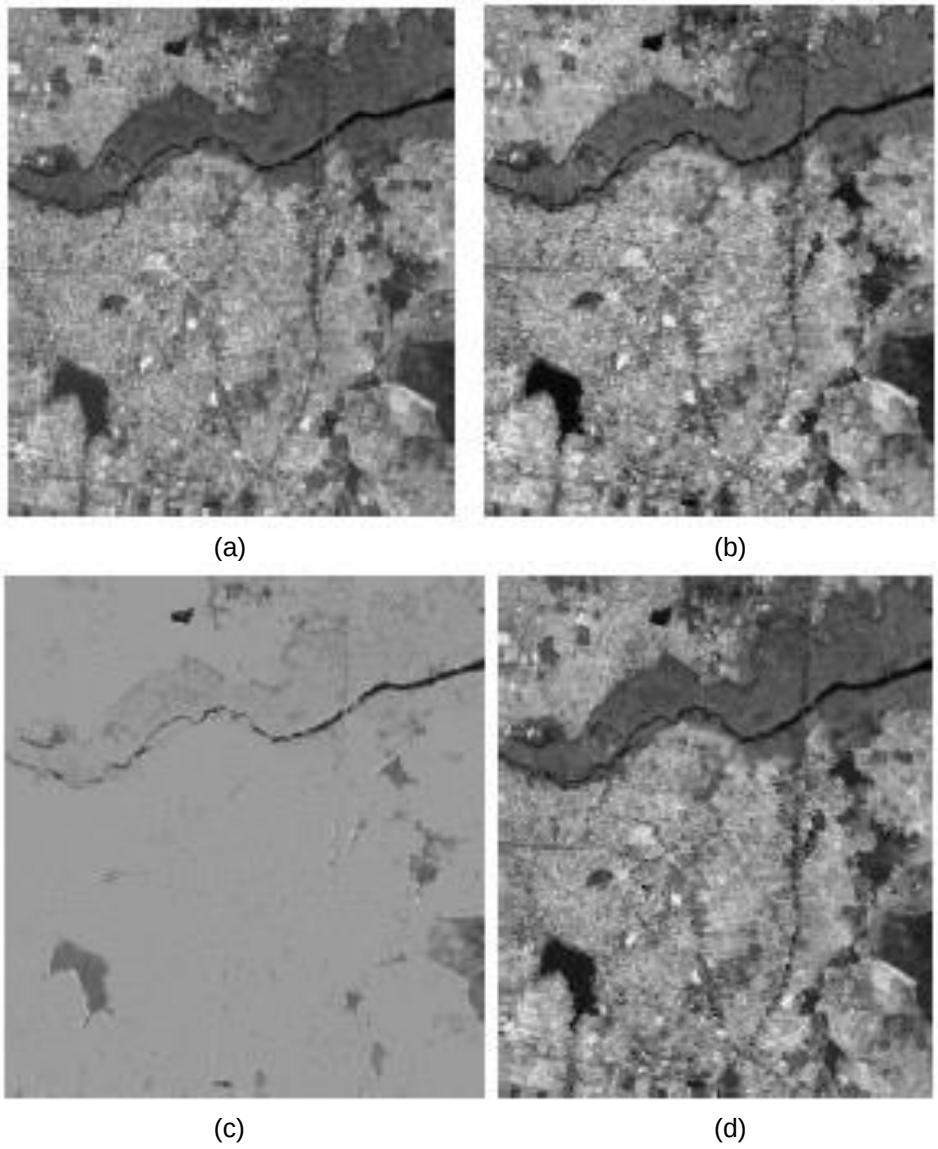
It is well known that the feedback network is adequate to achieve the function. Therefore, you can apply it to imitate all kinds of curves. Feedback network, however, shows two weak points. The first is the duration of the training, while the other is the weakness in the search for the globe [9]. Meantime, these weak points are quite clear in the nonlinear system. The fuzzy neuron network, however, makes a better re-distribution network appear. This piece reading shows how to put the fuzzy element between the input element and the hidden element back common network. Small values here are inserted in larger values. Thus, the difficulty of the whole problem is overcome.

Artificial neural network has also a great strong point – to value the link between the inner and outer, when we do not know them (especially if the link is nonlinear). In short, the artificial neural network has two core elements - the test and the train. Training is about getting training information and its correlation metrics. In this way, learning by example and obtaining the most useful data from it

becomes possible. Retrieving the function is actually the primary first step for the artificial neural network.

Artificial neural networks are usually presented as systems of interconnected "neurons" that can calculate values from inputs. Artificial neurons are the constitutive units in an artificial neural network. The first artificial neuron was the Threshold Logic Unit (TLU) first proposed by Warren McCulloch and Walter Pitts in 1943. As a transfer function, it uses a threshold equivalent to the use of the Heaviside step. An artificial neural network that uses a linear threshold function is Perceptron developed by Rosenblatt.

Experimental results



(a) (b)

(c) (d)

Fig. 1: (a), (b) original input images [10]; (c) fused image by fuzzy logic,
(d) fused image by neuro fuzzy logic [10]

There are a large number of applications like medical imaging, video surveillance and remote sensing etc. that require images with both spatial and spectral resolution as well. Gathered images are primarily used for human observers for viewing or interpreting and for further processing from a computer using various imaging techniques.

In our work the orthophoto images have been processed with different classification techniques and then fused with different fusing methods in terms to be used for further segmentation. This was done in case the result image to be used for the active contour model, also called snakes, is a framework for delineating an object outline from a possibly noisy 2D image. This is an algorithm implementation that stays at the beginning of the self-organizing road map (SORM). The SORM

method is made from different combinations of methods and algorithms. In our work the neuro fuzzy logic used for image fusion shows the best results and it is going to be used for further applications. The priorities and advantages of this method are shown and unravel above.

The results were implemented on Python, Matlab and C++. But they show that there is no significant improvement in fusing the classified images. In our case, only one classifier is selected. The Mahalanobis distance method was used to be implementer to classify the image. Other methods are quite similar, so there is no need for synthesis for further processing. This does not diminish the results. Synthesis methods are a powerful tool that can be used in many applications.

Conclusions and future plans

Data merging is very useful for retrieving features in a remotely recognized image. The characteristics can be listed by mismatched sources of information. Retrieval algorithms end with multiple images of one particular element. Data merger, though, allows you to make cooperation between all these images.

This article showed two of the most important approaches for merging data and their use in the extraction of roads. There are several other methods and you can find them in the scientific literature. Using the data is not limited when it comes to these methods. When it comes to choosing the way of merger exact question determines the selection.

In conclusion, to overcome the drawbacks of traditional merging schemes, and to integrate as much information as possible into the fused images exploiting the advantages of the fuzzy logic is an aim that has to be achieved.

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