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Analysis of the Display of Digital Terrain Models using Different Interpolation Methods

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ABSTRACT. In the paper is described the process of creating digital terrain models (DTM) using different interpolation methods. The analyses show the accuracy of the DTM obtained from topographic maps at different scales and using different interpolation methods. The quality and accuracy of DTM depends on the complexity of the terrain, data sources, and methods of height interpolation. The basic idea is the creation of the DTM for the selected area and the comparison of the results by applying appropriate interpolation methods. The aim of the research is to analyse the quality of the DTM model and to consider suitability of certain interpolation methods, based on the obtained results, i.e. their advantages and disadvantages. The experiment was done in the software environment ERDAS IMAGINE 2014.

Keywords: DTM, interpolation, method of inverse distance weight, spline, kriging, analysis of quality data.

1. Introduction

Presentation of the Earth surface and various spatial analyses using technologies of digital terrain modeling are more and more in use. As requirements in terms of accuracy, quality and speed of obtaining digital elevation model are increasing, the problem occurs primarily in the choice of the most suitable interpolation method for obtaining DTM. This paper deals with DTM, i.e. interpretation of terrain with help of different interpolation methods and with different level of detail. The aim of the research is the analysis of the quality of DTM depending on the interpolation method and level of detail of the data, i.e. the complexity of the terrain.

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The basic idea of this project is DTM creation by interpolation methods from the topographic maps (TM) at different scales for specified – identical area of interest. Thereby, three interpolation methods are processed.The practical part of the paper describes the method of collecting and modeling of the data, and the process of obtaining the DTM.

The main sources of information are topographic maps at scales 1:25000, 1:50000 and 1:100000, covering part of the territory of Bijeljina (Republic of Srpska, Bosnia and Herzegovina). After that, DTMs with different interpolation methods are formed and analysed in terms of accuracy and displayed quality. Data processing and analysis, i.e. vectorization, modeling and accuracy assessment of the model were carried out in the software environment Erdas Imagine. The final part includes the presentation of the conclusions.

2. Digital terrain modeling

The introduction of the term digital data modeling and digital terrain modeling is attributed to two American engineers from the Massachusetts Institute of Technology. The definition that they gave is following (ESRI 2010): “The digital terrain model – DTM is a statistical performance of continuous surface of terrain, with a large number of selected points with known X, Y and Z coordinates in the specified coordinate system.” Since then, in foreign literature more similar terms and definitions are in use. Some of them refer to the same or similar concepts, while others are significantly different, so it should be paid attention to it.

Thereby, in practice, the most common terms are:
- digital elevation model
- digital terrain model
- digital surface model.

Digital elevation model – DEM (rarely Digital Height Model – DHM) is a name that derives from German-speaking countries, which typically refers to an elevation system of a regular points grid. That is a rectangular grid or cells matrix covering a certain surface of the field (Fig. 1).

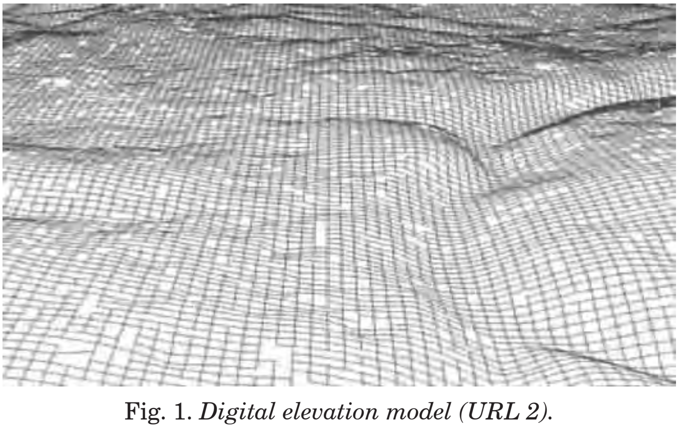

Fig. 1. *Digital elevation model (URL 2).*

The digital terrain model – DTM, is more complex concept and includes not only the elevation of points, but also other characteristics of the terrain, such as breaking and structural lines and characteristic points (Fig. 2). In addition, DTM may also contain other derived information such as slopes, aspects, field discontinuity, etc.

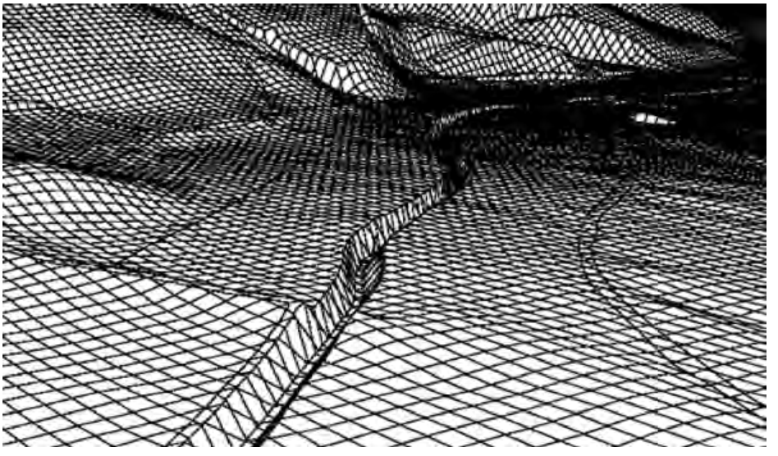

Fig. 2. *Digital terrain model (URL 2).*

Thereby, in the narrow sense, a DTM represents the relief of the terrain, while the broader sense of the term can also include objects and phenomena on the given surface. In this case it is a digital surface model – DSM. Unlike the previous two terms related to "naked" surface terrain, DSM includes roads, hydrography, vegetation and other objects that are directly on the terrain surface (Fig. 3).

Fig. 3. *Digital surface model (URL 2).*

In the literature are to be found other terms of 3D models of geodata as well. One of them is the DTED (Digital Terrain Elevation Data), which uses for their products the National Geospatial-Intelligence Agency of the United States – NGA, (old name: The National Imaging and Mapping Agency – NIMA) (URL 3).

2.1. Interpolation techniques for digital terrain modeling

Evaluation, or interpolation, can be made in one, two or three dimensions. The assessment can be made using the known values of the observed primary variables (autocorrelation) or with the value of one or more secondary variables in the same area, under the condition that the secondary variables are strongly correlated with the primary variable. There are also a number of methods that include bilinear and bicubic interpolation in two dimensions, and trilinear interpolation in three dimensions (Medved et al. 2010).

Unlike traditional statistical approach, geostatistics consider geospatial dependence of the variable. The geostatistical interpolation methods assume that a value knowledge of some attributes at familiar points, allows establishing the value at the unknown points. Assuming that the samples are representative and consistent, values of corresponding variables on a new location s_o can be obtained using appropriate interpolation methods.

They represent the most probable location or set equally probable location-element of interest defined through the list of input data, described by equation (1):

$$z(s_o) = E\left\{Z \middle| z(s_i), q_k(s_o), \gamma(h), s \in A\right\} \quad (1)$$

where:

$z(s_i)$ – set of input point data

$\gamma(h)$ – covariance model, which defines the spatial structure of auto-correlation

$q_k(s_o)$ – set of predictors, known values and variables, which should be available at any location in the A space.

2.1.1. The method of inverse distance weight

One of the oldest interpolation techniques (methods) is a method of inverse distance weight (IDW). In this method, the value of the corresponding variable at a new location can be obtained as the average weight, using the formula (2):

$$z(s_o) = \sum_{i=1}^{n} \lambda_i(s_o) \cdot z(s_i) \quad (2)$$

where:

λ_i – corresponding weight for the environment i

$z(s_i)$ – set of input point data.

Sum of weight must provide impartial interpolator. Example in a matrix form is described by equation (3):

$$z(s_o) = \lambda_0^T \cdot z \tag{3}$$

The simplest way to determine the weight is to use the inverse distance of all points to a new point, which is represented by formula (4):

$$\lambda_i(s_o) = \frac{\dfrac{1}{d^{\beta}(s_0, s_i)}}{\sum_{i=0}^{n} \dfrac{1}{d^{\beta}(s_0, s_i)}}; \quad \beta > 1 \tag{4}$$

where:

$d^{\beta}(s_0, s_i)$ – the distance from a new point to a known point

β – coefficient, which is used to adjust the weights.

The principle of using the method of inverse distance weighting is largely a reflection of Waldo Tobler's first law of geography, which states: "Everything is interconnected with everything, but things that are close to each other are more connected than those that are far away." Therefore, points that are close to the output pixel will contain greater weight, while those that are further away from that pixel, will have lower weight. The parameter β is used to emphasize the spatial similarity. If β increases, the less importance will be given to the remote points.

The method of inverse distance weighting is interpolation method that fits in continuous models, i.e. surfaces or spatial variations. The output pixel value in this method is limited by the values that were used for interpolation. As the average value is used, it can not be greater or lower than the maximum, or a minimum value of the input data. So, this method does not take values that do not already exist in the set of input data.

The best results are obtained when sampling is sufficiently dense, with the emphasis on local variations that are attempted to be simulated. If input points samples are rare or non-planar, results may not satisfyingly represent the specified surface. The impact of these input points to the interpolated value is isotropic. If there are points on a common (same) location having the same x, y coordinates, they are considered duplicates, and do not affect the output data. If the values of these points are different, it is considered that these points coincide. In any case, it is better to remove these points before the interpolation process. If two points are on the border of two separate surfaces, topological separation is not necessary. These points will be included in the interpolation with the both surfaces. The maximum point number for using this method defines a software package. However, if the surface contains more than this number, it is necessary to split on more surfaces, and separately interpolate, in order to avoid blocking, errors, etc. (Davidović 2015).

2.1.2. Spline method

A particular group of interpolations is based on the splines. Spline is a type of polynomial in parts, that is desirable for simple polynomial interpolation, because the more parameters can be defined, including smoothing. Smoothing spline functions (equalization) also assumes that there is an error in the measurement, i.e. in the data, that needs to be locally smoothed. There are many versions and modifications of spline interpolator. The most widely used techniques are thin plates spline, regularized, and spline with tension and smoothing. Predictions are obtained as follows:

$$z(s_o) = a_1 + \sum_{i=1}^{n} w_i \cdot R(v_i) \tag{5}$$

where:

a_1 – constant

$R(v_i)$ – the radial based function (which is why this method is also called the method with radial basis functions) is determined using:

$$\begin{aligned} R(v_i) &= -\left[E_1(v_i) + \ln(v_i) + C_E\right] \\ v_1 &= \left[\varphi \cdot \frac{h_0}{2}\right]^2 \end{aligned} \tag{6}$$

where:

$E_1(v_i)$ – exponential integral function

$\ln(v_i)$ – logarithm function

C_E = 0.577215 – Oiler constant

φ – the generalized parameter tensions

h_0 – the distance between the new and the interpolated point.

The coefficients a_1 and w_i are obtained by solving the system:

$$\begin{aligned} &\sum_{i=1}^{n} w_i = 0 \\ a_1 + \sum_{i=1}^{n} w_i \cdot &\left[R(v_i) + \delta_{ij} \cdot \frac{\varpi_0}{\varpi_i}\right] = z(s_i); \quad j = 1,..,n \end{aligned} \tag{7}$$

where:

$R(v_i)$ – the radial based function

$z(s_i)$ – set of input point data

$\frac{\varpi_0}{\varpi_i}$ – positive weight factors which are smoothing parameter at any given point s_i.

Tension parameter φ controls the distance over which given points could has an impact on the resulting surface, while smoothing parameter controls the vertical deviation of the point surface. Using the appropriate combination of tension and smoothing, this method of interpolation can create surface that exactly corresponds to the expected variations (Hengl 2009).

This method interpolates raster surface from points using a two-dimensional minimum curvature spline technique. The resulting flat, smooth surface goes exactly through the input points. If there are points on a common (same) location having the same x, y coordinates, they are considered duplicates, and do not affect the output data. In any case, it is better to remove these points before the interpolation process is done.

Determination of spline functions is performed for each rectangle separately, provided that the assessment is used for all data from the rectangle, plus all the data from neighboring rectangles. The set of rectangles, from which data are taken for the spline functions determination can be expanded until the sum of the input data (points) is larger than the specified.

The optimum size of the rectangle is obtained by setting the term that the amount of data in the rectangle together with the data from all the neighboring rectangles does not exceed a specified value. In software applications segmented data processing is automatically done, but the user can specify some of the processing parameters (minimum number of points for the spline functions calculation, the rectangle size, the number of nearby rectangles that should be considered, etc.). Regularized spline produces flatter (smoother) surface comparing to the spline with tension.

2.1.3. Kriging method

Theoretically, the most accurate result in some surface modeling based on measured values at the reference points should be expected when using geostatistical methods. This group includes:

- collocation according to the minimum square method
- kriging.

Kriging assessment is based on the use of known values of a variable control points, whose influence on the assessment is expressed by the relevant weighting coefficients. The most demanding kriging procedure is individually weight coefficients determination for each control point. These criteria must be satisfied assessment process: it is ought to be impartial and configured in the way that the difference of the variance between actual and estimated values is the smallest in selected points (Medved et al. 2010).

Kriging is a geostatistical interpolation method, which has, due to reliable estimations of spatially distributed variables, found application in various fields of scientific research. It was created for the needs of the mining industry in the early 1950s as a mean to improve the assessment of the ore reserves. The original idea came from mining engineer D.G.Krige and statistician H.S.Sichel. The technique was published in 1951, but it took almost the entire decade before the French mathematician G. Matheron formed formula and founded the entire field of linear geostatistics. Since then, many different versions of kriging are used (Varga and Bašić 2013). The kriging method is presented using a mathematical formula, as for IDW method (8):

$$z(s_o) = \sum_{i=1}^{n} \lambda_i \cdot z(s_i) \qquad (8)$$

where:

λ_i – correspodent weight for the environment i

s_0 – location that is predicted

n – the number of measured values

$z(s_i)$ – the measured value of this location.

Therefore, IDW method weight λ depends only on the distance to a location that is predicted, while in kriging method, the weights are based not only on the distance, but also on the overall spatial arrangement of measured points. In order to use overall spatial arrangement, spatial autocorrelation should be calculated. Therefore, in the ordinary kriging (which is used in this paper), the weight λ depends on the model formed by the measured points, the distance to a location that is predicting and the spatial connection between the measured values in the nearby of locations that need to be obtained, i.e. predict.

3. Method of production and visualisation of DTM

There are many programs that are used to create and visualize spatial data. Some simple programs use only the basic functions of 3D production, while other more complex applications provide advanced and realistic representations. Most professional programs are commercial, and they are free for certain limited purposes. Commercial software usually comes in the combination of the 3D display main elements, with additional features, such as GIS applications (Župan and Rezo 2014).

In this paper for processing, analysis and spatial data visualization Erdas Imagine 2014 was used. Also, Erdas software environment, provides a multitude of tools such as those for image ortorectification, mosaicing, redesigning, different conversion (rasterization, vectorization), digital terrain modeling, image classification and interpretation, which provides the user with image data analysis and display them in various forms from 2D images to 3D models (URL 5).

Practical part of the work deals with methods of making digital elevation model at the selected test-area. At first, it is a necessary to choose workspace that represents a particular representative field, processed with earlier analysed methodology – in order to verify its validity and justification in practice. The result of processing should be a model of geospatial data collected by digitizing existing DTM, presented in a suitable format, and the necessary conclusions and recommendations arising from this task. It is necessary to fulfill some other conditions, to make test-area valid. They relate primarily to the selection of areas that need to be diverse in content, that is not too big, that it does not require additional work, except than those intended, and does not require additional material costs (URL 2).

At the end of this part the obtained results are presented and compared, wich were the aim of the work. Since the vectorization content is done, we started data rasterization, with appropriate interpolation methods (URL 5). In Fig. 4, the results that are achieved by the IDW interpolation are given.

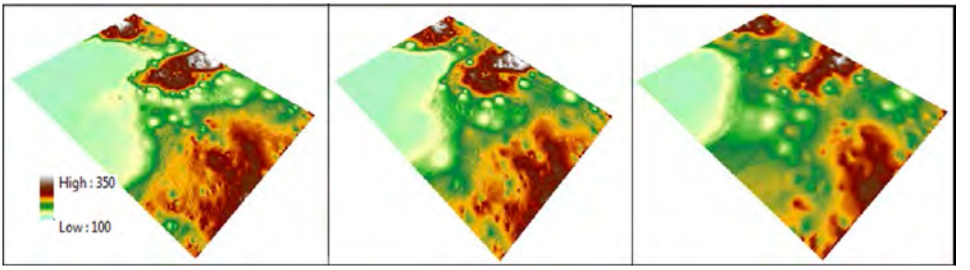

Fig. 4. *DTM obtained by IDW interpolation (TK 25, TK50, TK100).*

In Fig. 5, the results obtained by spline method are shown.

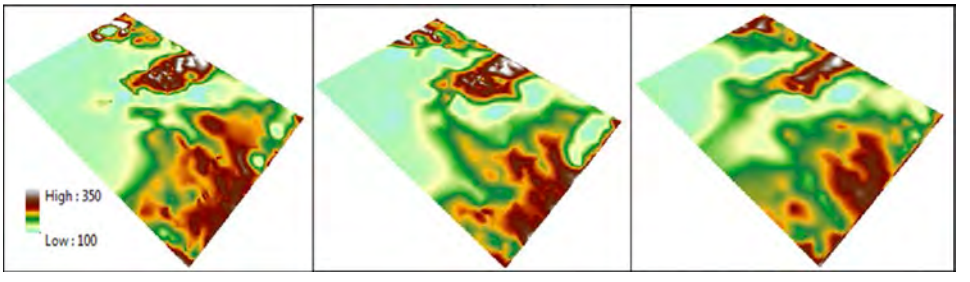

Fig. 5. *DTM obtained by SPLINE interpolation (TK 25, TK50, TK100).*

In Fig. 6, the results obtained by kriging method are shown.

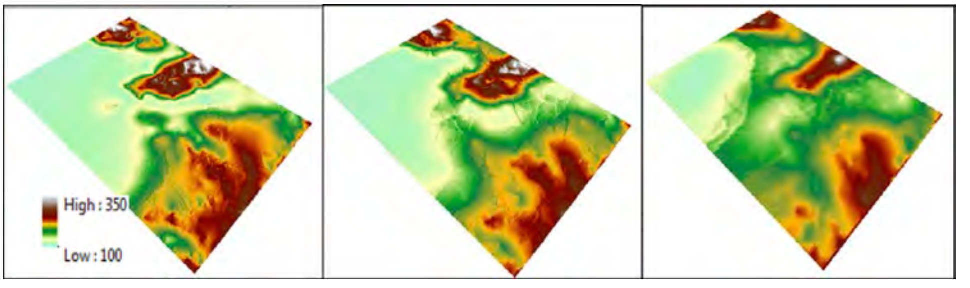

Fig. 6. *DTM obtained by KRIGING interpolation (TK 25, TK50, TK100).*

Due to the different data interpolation methods and their display on the maps, it is possible to get a reliable model that can represent as best as possible a particular set of spatial data. Dynamic display of DMT and visualizations leaves much stronger impression to users than the presentation in another form (Župan and Rezo 2014). Regular spatial network is used to generate different map types that can be used to display contour lines, vectors, shaded relief, three-dimensional surface model, and more.

4. Analysis and results discussion

At the same set of data (sheet of map Bijeljina at scales 1:25000, 1:50000, and 1:100000) the three previously described interpolation methods were applied and compared: kriging, inverse distance weight and spline. The process of creating DTM was consisted of the following phases of work:

- Elements of mathematical and geographical cartographic data base sources were analyzed
- Quality and characteristics of geomorphology were considered
- Digitalisation of data (contour lines set) is done
- Contour lines were transformed (converted) into points
- Interpolation by the above mentioned methods was conducted.

During the analysis should be kept in mind that the treated geographical area, obtained from the topographic maps at different scales 1:25000, 1:50000 and 1:100000 is identical. The geodetic datum, projection, zone and other parameters were also taken into consideration. After vectorization, contours were splited into a point cloud and the grid or DEM was made (for TM 25 is 25m, for TM 50 is 50m and for TM 100 is 100 m), with above described interpolation methods. After that, properly selected and sufficient dense control points were distributed, and based on them, statistics were carefully done, i.e. accuracy assessment of the model was conducted.

As it is already mentioned in previous chapters, the project of comparing interpolation methods was performed using the software environment Erdas Imagine. Also, vectorization in this program is carried out, as well as a comparison of the outputs of different interpolation methods. In assessing the geometric accuracy elements that define the vertical position of the point are tested. Accuracy assessment is obtained from the difference between the model tested point coordinates to their true values, i.e. the coordinate values of a higher accuracy degree from the tested points. The measure of accuracy is the basic (statistical) Root Mean Square Error (RMSE), with the procedure for the maps quality analysis.

Digital terrain model quality assessment defines the accuracy degree with help of which the terrain surface by digital model is presented. The standard procedure for assessing the DEM quality is a comparison of interpolated heights from generated DEM with the given heights for specified number of control points, where the heights of the control points must be made with greater accuracy than the expected accuracy of the DEM. Differences are based on the formula:

$$\Delta i = Z_i^T - Z_i^I, \quad i = 1,2,\ldots,n \tag{9}$$

where:

Z_i^T – provided control points height

Z_i^I – checkpoint height obtained by interpolation

n – the number of control points.

After that, root mean square error (RMSE) equation can be formulated:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} \Delta i^2}{n-1}} \tag{10}$$

Depending on the topographic maps scale, there are limitations in terms of reading and tolerances. As control points on a topographic map, angles were used. For each of the base (DTM), graphical and tabular presentation was obtained. By the term graphic display obtained DTM is ment, and by tabular display the coordinates comparing table of TK control points with coordinates of pixels from DTM are ment.

4.1. Application analysis of the same methods over data at different scales

These techniques have been implemented for interpolation at every scale, i.e. 3 methods and 3 scales (9 results comparisons in total). Display analysis is a method of determining the differences in the properties and extraction the areas with specified properties. These properties may be, for example, relief characteristics, differences in the vegetation development, the intensity of tone in black – and – white images, or different colors on the pseudo color images and color composites, etc. (URL 1).

Display (recording) analysis in principle can be done in two fundamentally different ways. The first method represents a visual or logical, while other represents instrumental or formal analysis. Each of them has certain advantages and limitations. The best results are obtained by combining both procedures.

For analyzing the data in the same method and different scale, it is most appropriate to use visual analysis. Visual or logical analysis is carried out by observation of the obtained digital model, noticing the difference and exclusion of anomalous areas, that are very different from the environment by certain characteristics. The advantage of this procedure is the possibility of a logical selection data. Anyone analysing images would set aside an anomalous area of the rapidly dimming black-and-white images, basing their criteria on the fact that the rocks with a different composition have different color, or gray tone intensity in the black – and – white snapshot. In the second case, the extremely dark tone area observed on the canyon side would be ignored, because it is clearly shadow of something (URL 4).

IDW Interpolation

Fig. 7 shows the digital elevation model derived by IDW interpolation, at scales 1:25000, 1:50000 and 1:100000, respectively.

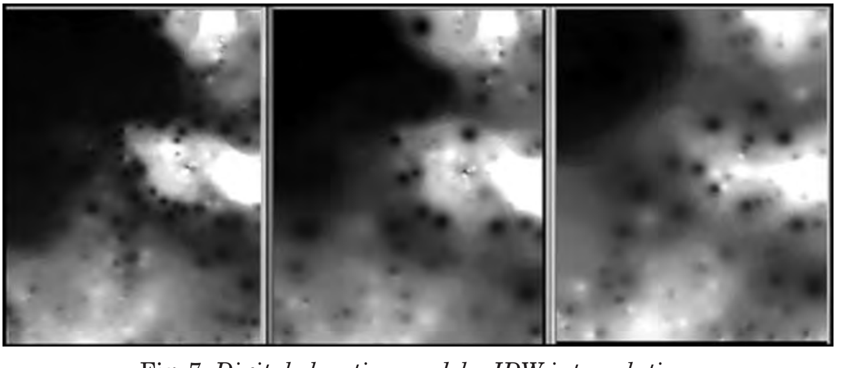

Fig. 7. *Digital elevation model – IDW interpolation.*

In the visual data analysis, it can be concluded that the first picture from left is the most detailed, i.e. range of color shades is wider. There are bright and dark shades comparing to the other images. Also, here are the tiniest details (dark spots that can not be seen in other pictures). Similarly, the second picture has more details in comparasion to the third image (scale 1:100000). So, it follows that the best 3D model is the one at the largest scale (1:25000).

Spline interpolation

Fig. 8 shows the 3D models obtained by spline interpolation, at scales of 1:25000, 1:50000 and 1:100000, respectively.

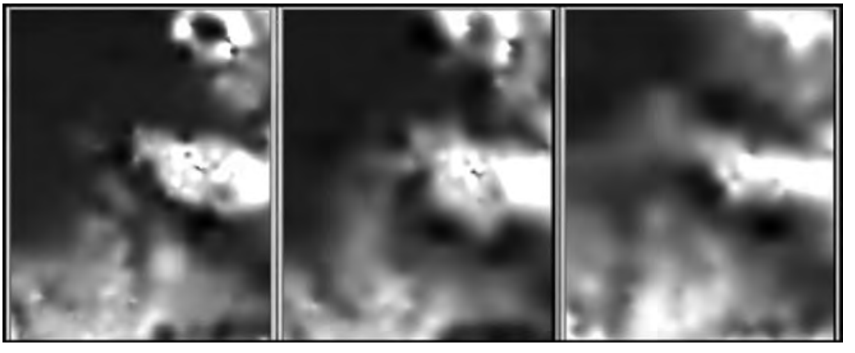

Fig. 8. *Digital elevation model – SPLINE interpolation.*

As with the previous method, it is obvious that the image at scale 1:25000 (first image) is the most appropriate.

Kriging interpolation

Fig. 9 shows the 3D models obtained by kriging interpolation, at scales of 1:25000, 1:50000 and 1:100000, respectively.

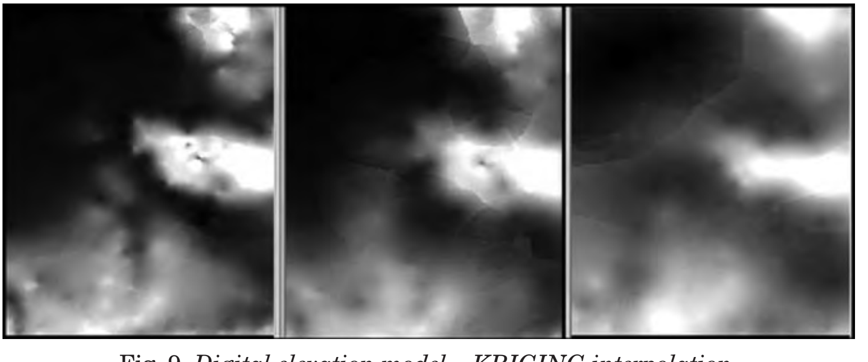

Fig. 9. *Digital elevation model – KRIGING interpolation.*

Visual analysis indicates that the best DEM in this method is at scale 1:25000. The DEM at scale 1:100000 has the least details and minimum color shades, DEM at scale 1:50000 provides more details than the previous one, while the DEM at the largest scale, represents the most detailed and the most realistic terrain.

4.2. Application analysis of different methods in data at the same scale

Formal analysis is based on previous explained procedure – obtainning root mean square error. The tables below show the comparison of TM control points with coordinates of pixels from DTM. The same seven, properly distributed, control points for each interpolation methods at the same scale are used. The obtained results are shown in Table 1.

Table 1. *Comparing control point heights with heights obtained by different interpolation methods.*

Topographic map at scale		**1 : 25 000**			**1 : 50 000**			**1 : 100 000**		
Ordinal point number	**Control point height**	INTERPOLATION METHODS								
		IDW	**Spline**	**Kriging**	**IDW**	**Spline**	**Kriging**	**IDW**	**Spline**	**Kriging**
1	138	145.0	141.7	142.9	133.0	132.9	132.0	155.2	151.4	150.0
2	111	111.1	107.7	110.4	114.4	108.4	108.7	118.4	108.0	115.5
3	110	110.0	110.0	110.0	110.0	110.0	110.0	114.8	115.0	115.4
4	225	226.6	226.6	226.6	227.3	228.9	227.5	228.9	237.4	227.5
5	112	110.5	110.7	110.8	110.0	109.7	109.5	110.5	107.9	114.6
6	178	175.8	182.8	175.5	184.8	175	180.5	168.0	167.7	161.4
7	129	131.4	126.5	128.8	140.9	124.7	136.2	142.4	128.5	137.9

After comparing the data obtained by the same method at a different scale, it is evident that the best scale is 1:25000. Comparison of different methods of interpolation is carried out using formal analysis. Formal analysis is performed in instrumental computer-supported way. There are exclusively recordings in digital form, and the whole procedure is known as digital analysis. The essential advantage of the formal on the logical analysis is the far greater range of differences in properties that can be registered, and the objectivity of the procedure. Digital analysis allows extraction of the bigger number of tonal differences but simply visual observation (URL 4).

Analyzing the data in the tables above, it is noticeable that the slightest deviation in altitude conditions are at scale 1:25000, then at scale 1:50000, and at the scale of 1:100000. It is to be expected, because the larger scale gives greater accuracy – as shown in visual analysis. From these tables is calculated, as described above, the RMSE. Results table of data processing is displayed in Table 2.

Table 2. *RMSE – root mean square error by obtained DEM.*

Scale	IDW interpolation [m]	SPLINE interpolation [m]	KRIGING interpolation [m]
1 : 25 000	3.13	2.94	2.40
1 : 50 000	3.92	3.23	3.16
1 : 100 000	9.05	9.03	8.97

From the Table 2 it is evident that the kriging method is the best, and that it gives the best results, because of its smallest error. Then the spline method, while the IDW method has the largest deviation, i.e. the highest RMSE. If the significance of the closeness of these results is given, it is striking that the kriging method and spline are very close. Spline with tension and smoothing, on the one hand, is the equivalent of ordinary kriging, where the coordinates are used to describe a specific part of the variation, and give very similar results.

However, their greatest weakness is that the parameters of smoothing tensions are normally set by the user, based on experience. Thus, it is clear that the differences between these methods are very small, and that all these RMSE are in the allowable ranges, in accordance with scales. Looking at the resulting root mean square errors, higher figures at scale 1:100000, compared to the other two, are observed. The reason for this is the manual vectorization, which is performed before the DEM formation.

5. Conclusion

This paper presents some of the ways to obtain DEM, using a specific interpolation methods. It should be noted that only some of the interpolation method are implemented for obtaining DEM. After careful analyses, it is clear that in selecting the interpolation method, it is necessary to pay attention to the nature of the input data, the modeled surfaces characteristics and the degree of modeling objectivity. Also, the software environment is importan. From the mathematical point of view, the reliable DEM must have surface geometric continuity, and the possibility of differentiability and smoothness surface at any point. In practice, however, good DEM considers the model that illustrates the terrain topography confidentially and well. The analysis of the three different interpolation methods, i.e. the method of inverse distance weighting, spline and kriging method, over the same set of spatial data of the selected areas carry out important conclusions.

In the interpretation of spatial data continuity and terrain topography, the best results were obtained by kriging method. Similar representations are obtained by the spline method and the method of inverse distance weight, but statistical indicators of kriging methods give better values. The statistics for the kriging method show the smallest values of the standard deviation and the deviation comparing to other methods, from which it follows that the interpolated values are the closest to the measured input values. All this results in a more reliable and accurate terrain model.

Performing of a visual analysis in this paper leads to the conclusion that, if the modeled surface characteristics are known, then what should be chosen is the one that shows in a best way the surface (eg. the one that contains the greatest range of color shades). Also, the mean square error (RMSE) values are closest to the limit, and have a maximum value at scale 1:100000. There also occur errors as a consequence of content vectorization at smaller scale, because the other cartographic basis (scales 1:25000 and 1:50000) are more detailed.

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Analiza prikaza digitalnih modela terena primjenom različitih metoda interpolacije

SAŽETAK. Rad opisuje postupak izrade digitalnih modela terena (DMT) primjenom različitih metoda interpolacije. Pritom se analiziraju prikaz i točnost DMT-a, dobiveni s topografskih karata različitih mjerila te primjenom različitih metoda interpolacije. Kvaliteta i točnost DMT-a ovise o složenosti reljefa, izvoru podataka, ali i o metodi interpolacije visina. Osnovna ideja u radu je kreiranje DMT-a za izabrano područje te primjenom odgovarajućih metoda interpolacije usporediti dobivene rezultate. Cilj istraživanja je analizirati kvalitetu DMT-a te na temelju dobivenih rezultata razmotriti pogodnost pojedinih metoda interpolacije, odnosno njihove prednosti i mane. Istraživanje je realizirano u softverskom okruženju ERDAS IMAGINE 2014.

Ključne riječi: DMT, interpolacija, metoda inverzne udaljenosti, spline, kriging, analiza kvalitete podataka.

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