AUTOMATED DETECTION OF PROSPECTIVE SITES RELATION TO SPECTRAL CHANNELS KOSMOSNIMKA AND FAMOUS REFERENCES OF THE MALGUZAR AREA (MALGUZAR MOUNTAINS)

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ANNOTATION

The work was carried out with the use of digital space survey materials and effective methods of forecasting, prospecting and exploration of mineral resources, the use of space survey materials is firmly included in the practice of geological exploration and the use of GIS technologies is becoming mandatory.

KEYWORDS: *interpretation, remote sensing of the Earth, ring structures, structurally decoded complexes, intrusive complexes, criteria, prospective areas, tectonics, interpretation, digital processing, color anomalies.*

DISCUSSION

The systematization and generalization of materials on the gold content of the Malguzar mountains make it possible to recommend the continuation of prospecting works aimed at revealing hidden gold ore objects. The Malguzar mountains are located at the north-western end of the Turkestan ridge (South Tien Shan), north-north-western orientation, 120 km long and 30-45 km wide. From the Chumkurtau ridge, located to the south, they are separated by a narrow river valley. Sanzar [1, 2].

Automated allocation of promising areas by the method of multiple coincidences on the spectral channels of a satellite image to known reference objects for the subsequent conduct of geological exploration.

One of the main stages of work is the creation of a description space with a combination of various spectral channels of space images or their features, describing the territory and reflecting certain aspects of the phenomenon or process under study. Initially, the original space image is processed, since when solving many geological problems, the direct application of the brightness characteristics of the initial space materials does not always give satisfactory results. To improve the results, the relative clarity of the image of satellite images (SI) is directly increased, the variability of the pixel values is reduced, which is achieved through the normalization of solar radiation by transforming the spectral brightness, i.e. atmospheric correction is performed. All these stages are calculated by algorithms built into the GIS program.

Most of the data that ends up in the hands of the end user is already atmospheric corrected. However, due to the fact that the process of correcting large amounts of data is fully automated, the algorithms used for the correction are calculated based on the averaged indicators, without taking into account the peculiarities of obtaining each specific image.

A common problem when using satellite imagery is cloudiness. A number of software packages for processing Earth remote sensing (ERS) relatively successfully cope with reducing the effect of cloudiness on the image, but it costs some money, is not applicable in all cases, and sometimes requires additional data on the state of the atmosphere at the time of the survey. To modify the model for a specific image and perform the correction, you must perform the following steps: The

main stages of this process: obtaining metadata, data analysis, modifying the model, launching the model.

The input snapshot in the model must be a single, multi-band file (channels 1, 2, 3, 4, 5, 7, combined using the Layer Stack module). The result of the program's work is an atmosphere-corrected image, the file format is unsigned 8 bit.

The next step is to enter cartographic data. Geological maps and schemes, presented mainly in paper form, were scanned, processed and spatially referenced. Further, by means of their vectorization, several sets of vector objects were formed, representing geological boundaries, fault structures, points of reference objects of hydrocarbon deposits. To ensure the possibility of joint analysis of geochemical data and geological materials, the latter were transformed into a grid view by calculating at the nodes of the regular network 100×100 m (coinciding with the geophysical network) a number of heuristic characteristics reflecting the structural relationships of geological objects: the distance from the network node to the nearest geological object of a certain type (for example, points of a reference object: Tangi, Avliye, Marjanbulak, etc.), the number of intersections of linear geological objects of one or more types (for example, faults and geological boundaries), as well as the density of faults and geological boundaries in a sliding neighborhood (where the density - the total length divided by the area of the neighborhood), etc. The obtained characteristics were used in the formation of the feature space, along with the physical fields.

The next step is to create thematic channels of various combinations, that is, we use the division method, which is practiced in many automated methods. The analysis of the existing algorithms for decoding the SI showed that when these algorithms are used, a high reliability of the selection of a particular class of objects in various images is not always achieved.

To improve the deciphering properties of natural and anthropogenic objects, various spectral transformations are used for SI, the essence of which is the transition from one space of spectral features to another. However, with a specific transformation, the decryption properties can increase only in some classes of objects, while in others they remain unchanged. Therefore, it is necessary to use various spectral transformations in the complex. Taking into account that the spectral brightness of images of objects strongly depends on the influence of external factors, when decoding remote sensing and detecting changes, it is necessary to apply in addition to algorithms based on transforming spectral brightness, algorithms using structural features. Structural features are preserved in different spectral channels, in contrast to spectral ones. When interpreting mountain structures, lands, soils and vegetation according to the proposed algorithm, it is necessary to use multi-zone SI of high or medium resolution with a sufficiently large number of spectral channels, and to detect changes using wavelet analysis, it is sufficient to use panchromatic images.

Thus, it becomes necessary to create thematic channels. Combinations of spectral channels of 42 types (1/2, 1/3, 2/3, 5/3, 5/7, 7/1, etc.) were used. Out of 42 thematic channels with different combinations, 6 functional images are created: 61-62-8; 57-54-43; 57-54-31-43-53-52-51-47-37-27-17-32-42-12; 6-76-46-36-26-16; 54-31-43; 61-62-57-54-31-43.

On the obtained SI, one of the standards is located on a cell (pixel) consisting of three layers, i.e., layers R1, G2, and B3 of the spectral channel. Each layer has its own attribute value, which serves to identify or describe the class, category, group to which the cell belongs, or to set a quantitative characteristic of the property that describes this raster, R1 - layer 55, second G - 46, third B - 49 When changing the combination of the CS channels to R4G5B6, the pixel values acquire other digital values (R4 channel = 87, G5 channel = 66, B6 channel = 37). As a result, we get a pixel with 6 values per one standard (121, 153, 131, 178, 182).

At the next stage, it will be necessary to solve two problems, the first is to find the average digital value and the second is to simultaneously cover the neighboring pixels, that is, to find the distribution of the values of the initial information over the neighboring zones.

To solve this problem, the module of the aggregate function is used. The aggregate function resamples the input raster to a coarse resolution based on a defined aggregation strategy (Sum, Min, Max, Mean, or median). The aggregate function works as follows: it multiplies the cell resolution of the input raster by the coefficient specified in the cell coefficient parameter. The resulting value corresponds to the resolution of the cells of the output raster. It maps the spatial scales of the output cells to the input raster.

The use of this module made it possible to obtain the desired resolution in the form of a grid and a cell value, which contains one digital value and increases the processing speed with a decrease in the memory size. A grid theme represents a geographic layer where space is divided into square cells. Each cell stores a numerical data value, conveys information about the geographic layer that it represents.

When viewing the attribute table under the value 735, the number of this value was 23 cells. For each calculated standard there are several tens of raster cells related to this standard; areas are highlighted where they are concentrated. So, in the study area, 653 cells were identified according to 6 standards.

Grid points covering known deposits were used as reference points. Since within the study area there are several localized groups of such zones located in different geological conditions, initially the entire set of reference objects (network nodes) was divided into 5 classes based on a priori structural and reflective representations. At the same time, spatially close objects were combined into one class. Since such a

division of the reference sample was initially carried out without taking into account the nature of the manifestation of objects in geophysical fields, special procedures for clustering objects were additionally performed using the IZODATA algorithms. After analyzing the clustering results, the list of reference class objects and their structure were changed. So, two of the five classes were combined, and vice versa, one of the classes was divided into two.

Further, on the basis of multidimensional scaling procedures, objects uncharacteristic for it were removed from each obtained class, which made it possible to significantly increase the degree of compactness of class images.

Depending on the information it represents, a grid topic can be created from both integer and floating point values. The estimation of the surface values between these points is carried out by averaging the values of the points of the neighboring zones, taking into account the degree of their proximity to the given point, but at the same time it is necessary to separate the small and large zones related to the location of the reference object. To do this, the "boundary clean" module is used to select high and low priority zones. The purpose of identifying these zones in the grid is to study adjacent values, and in what capacity they are common. So, if the reference object can be in the zone of small values, then it can be ignored during processing. For each grid with high and low priority values, processing is carried out to identify points related to the reference cells, and are calculated on the raster calculator, i.e., we calculate the common areas of pixels for different grids. This tool is designed for calculations that support multiple operators and functions, select queries, and map algebra syntax. The input data for the calculator can be grid datasets or raster layers.

For the next processing process, the Inverse Distance Weighted Method (DWM) is used. This interpolation method assumes that each input point has an impact that decreases with distance. Since the GIS forecasting unit works with data specified at the points of the regular grid, it becomes necessary to bring the initial data to a grid form, in which the data is correlated with the network nodes that form a finite set of objects $X = \{X1, X2,. ... ., Xn\}$. For this purpose, for the obtained SI in the grid format, signs are calculated - characteristics related to the nodes of the regular network: the distance from the network node to the nearest object of a certain type, the frequency of occurrence of objects in the sliding window. The closer the point is to the cell being processed, the greater its weight. The clustering module (The Cluster/Outlier Analysis) made it possible to calculate the weight values in order to find the degree of difference with neighboring areas, the location of the standards and the application of the values for their averaging.

The presence of a reference sample allows you to perform the stage of minimizing the description space. It is based on the search for a diagnostic set of features that best characterizes the territory in terms of its similarity with the reference sample of a specific value. Diagnostic sets are calculated using various decision rules and similarity measures; in this case, the probabilistic error of the set identification is estimated. The decision rule for which the probabilistic error of identifying the diagnostic set is minimized is recognized as optimal. Features that are not included in this set are excluded from further consideration. Using the algorithms built into the software, we calculate the average value of the reference objects and the DWM of each functional image, as a result, we get a grid theme and then we sum them up.

Then a statistical analysis of the neighborhood by grid themes was carried out within a rectangle of 6×6 cells.

At the next stage, recognition was carried out based on the nearest neighbor method with finding the Euclidean distance between objects in a multidimensional feature space. Recognition results are based on a diagnostic set of features (dimension 16), a diagnosing set of features and a set of geometric features (it includes features of roundness, shape, area, length, height) and only by a set of geometric features.

The following statistical characteristics are calculated within the neighborhood area: majority, maximum, mean, median, minimum, minority, range, standard deviation, sum, number of unique values. As a result, after using the procedure for calculating statistical characteristics, halos of potentially promising positions were identified.

The described technology covers the main stages of the prospecting process and is based on the processing and integrated analysis of materials from heterogeneous and multi-level surveys. The developed technique makes it possible to extract additional geological information from the spacecraft and to reveal structural elements that are not identified directly in the images and their transformations, which significantly increases the information content of space survey materials.

For an additional factor of identifying positions, the results obtained using a GIS project on a special analysis of the pattern recognition method were also used. The identified cells for each value of the geophysical data were summarized with the results obtained using the method described above. Thus, forecast maps were compiled for the interpretation of the Landsat TM, ASTER SI with favorable positions for the localization of endogenous mineralization. The promising positions with the integration of geophysical, geological data and remote sensing data have been identified.

Industrial deposits, small occurrences and ore points of various mineral resources of the region are localized in the Nurata and Turkestan-Alai metallogenic subzones, the Nuratino-Turkestan metallogenic zone, and the South Tien Shan metallogenic region. These subzones contain the Zarmitan deposit, the Marjanbulak ore field, the

Bakhmal shallow deposit, the Etymtau, Chetkisay ore occurrences, the Ravat, Uchkizlar gold mineralization points, etc.

The presence of latitudinal and sub latitudinal zones of crumpling and ruptures is characteristic of the localization of gold mineralization. Thus, through the identification of faults and the study of the relationship with mineralization based on GIS technologies in vector information processing software such as ArcGIS, using the functions of statistical processing, the final generalization of linear features is carried out. In addition, structural elements and faults were found that did not appear on the original KS.

All deposits and occurrences of gold belong to the gold-quartz low-sulfide formation, hydrothermal industrial type. These data facilitate the application of the method of processing hydrothermal components and the detection of photo tones of anomalous objects.

As a result, the final processing of the identified territories is carried out in software using the processing of vector information such as ArcGIS, where, using the functions of statistical processing, the final generalization of polygonal objects (selected territories) takes place. In addition, structural elements and faults were found that did not appear on the original remote sensing (RS).

Thus, in the course of the work, it was established that the main role in the distribution of mineralization belongs to structures of II-III and higher orders relative to the deep fault. The identified potentially promising zones were identified based on the results of integration, available information on the ratios of the RS channels, as well as the spectral signature of minerals and rocks. In addition, as a result of the research, two potentially promising areas were identified, which are recommended for further conducting more detailed geological prospecting works.

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