Exploration of mineral resource deposits based on analysis of aerial and satellite image data employing artificial intelligence methods

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We propose a solution to the problem of exploration of various mineral resource deposits, determination of their forms / classification of types (oil, gas, minerals, gold, etc.) with the help of satellite photography of the region of interest. Images received from satellite are processed and analyzed to reveal the presence of specific signs of deposits of various minerals. Course of data processing and making forecast can be divided into some stages:
Pre-processing of images. Normalization of color and luminosity characteristics, determination of the necessary contrast level and integration of a great number of separate photos into a single map of the region are performed.
Construction of semantic map image. Recognition of bitmapped image and allocation of objects and primitives known to system are realized.
Intelligent analysis. At this stage acquired information is analyzed with the help of a knowledge base, which contain so-called "attention landscapes" of experts.
Used methods of recognition and identification of images: a) combined method of image recognition, b)semantic analysis of posterized images, c) reconstruction of three-dimensional objects from bitmapped images, d)cognitive technology of processing and interpretation of images. This stage is fundamentally new and it distinguishes suggested technology from all others. Automatic registration of allocation of experts' attention – registration of so-called "attention landscape" of experts – is the base of the technology.
Landscapes of attention are, essentially, highly effective filters that cut off unnecessary information and emphasize exactly the factors used by an expert for making a decision.
The technology based on denoted principles involves the next stages, which are implemented in corresponding program agents. Training mode -> Creation of base of ophthalmologic images (OI) -> Processing and making generalized OI (GOI) -> Mode of recognition and interpretation of unknown images. Training mode includes noncontact registration of eye motion, reconstruction of "attention landscape" fixed by the expert, recording the comments of the expert who is a specialist in the field of images' interpretation, and transfer this information into knowledge base.Creation of base of ophthalmologic images (OI) includes making semantic contacts from great number of OI based on analysis of OI and expert's comments.Processing of OI and making generalized OI (GOI) is realized by inductive logic algorithms and consists in synthesis of structural invariants of OI. The mode of recognition and interpretation of unknown images consists of several stages, which include: comparison of unknown image with the base of structural invariants of OI; revealing of structural invariants in unknown images; ynthesis of interpretive message of the structural invariants base and OI base (the experts' comments stored in it).
We want to emphasize that the training mode does not assume special involvement of experts to teach the system – it is realized in the process of regular experts' work on image interpretation and it becomes possible after installation of a special apparatus for non contact registration of experts' attention.
Consequently, the technology, which principles is described there, provides fundamentally new effective solution to the problem of exploration of mineral resource deposits based on computer analysis of aerial and satellite image data.