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Localized Smart-Interpretation

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The complex task of setting up a geological model consists not only of combining available geological information into a conceptual plausible model, but also requires consistency with availably data, e.g. geophysical data. However, in many cases the direct geological information, e.g borehole samples, are very sparse, so in order to create a geological model, the geologist needs to rely on the geophysical data. The problem is however, that the amount of geophysical data in many cases are so vast that it is practically impossible to integrate all of them in the manual interpretation process. This means that a lot of the information available from the geophysical surveys are unexploited, which is a problem, due to the fact that the resulting geological model does not fulfill its full potential and hence are less trustworthy.
We suggest an approach to geological modeling that

1. allow all geophysical data to be considered when building the geological model
2. is fast
3. allow quantification of geological modeling.

The method is constructed to build a statistical model, f(d,m), describing the relation between what the geologists interpret, d, and what the geologist knows, m. The para- meter m reflects any available information that can be quantified, such as geophysical data, the result of a geophysical inversion, elevation maps, etc... The parameter d reflects an actual interpretation, such as for example the depth to the base of a ground water reservoir. First we infer a statistical model f(d,m), by examining sets of actual interpretations made by a geological expert, [d1, d2, ...], and the information used to perform the interpretation; [m1, m2, ...]. This makes it possible to quantify how the geological expert performs interpolation through f(d,m). As the geological expert proceeds interpreting, the number of interpreted datapoints from which the statistical model is inferred increases, and therefore the accuracy of the statistical model increases. When a model f(d,m) successfully has been inferred, we are able to simulate how the geological expert would perform an interpretation given some external information m, through f(d|m). We will demonstrate this method applied on geological interpretation and densely sampled airborne electromagnetic data.
In short, our goal is to build a statistical model describing how a geological expert performs geological interpretation given some geophysical data. We then wish to use this statistical model to perform semi automatic interpretation, everywhere where such geophysical data exist, in a manner consistent with the choices made by a geological expert.
Benefits of such a statistical model are that

1. it provides a quantification of how a geological expert performs interpretation based on available diverse data
2. all available geophysical information can be used
3. it allows much faster interpretation of large data sets.