Seismic Attribute Database for Time Effective Literature Research

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SUMMARY

When we deal with seismic attributes we are often overwhelmed by the amount of attributes available in commercial software packages and described by literature. For interpreters of seismic data it is often hard to keep track of the attributes, their capabilities, and their application. If we just look into commercial available software packages we will see that one kind of attribute comes under different names. Over time we have collected numerous papers and abstracts dealing with seismic attributes and their application. These papers needed to be sorted by their attribute categories. Therefore we have decided to create an attribute database containing all necessary information on these papers. For the sorting we have developed a keyword-system that is divided into main and minor attributes. With this database it is now possible to generate queries for specific applications or attributes.
Introduction

When we deal with seismic attributes we are often overwhelmed by the amount of attributes available in commercial software packages and described by literature. For interpreters of seismic data it is often hard to keep track of the attributes, their capabilities, and their application. If we just look into commercial available software packages we will see that one kind of attribute comes under different names. Over time we have collected numerous papers and abstracts dealing with seismic attributes and their application. These papers needed to be sorted by their attribute categories. Therefore we have decided to create an attribute database containing all necessary information on these papers. For the sorting we have developed a keyword-system that is divided into main and minor attributes. With this database it is now possible to generate queries for specific applications or attributes.

Workflow for assembling an attribute database

The workflow for assembling an attribute database is structured in three parts (see figure 1). The first part is a principal literature study, the second part is the classification step, and the third part consists of creating useful queries within the database.

The first part for the creation of an attribute database is a classical literature research. This includes reading papers from approximately 65 different journals and about 55 different conferences. This step is the most time consuming process in assembling the attribute database. In total about a 1000 papers and abstracts were read, whereas about 750 of them were chosen to be in the database. The amount of papers is overwhelming and over time it gets impossible to stay on top of the things. Therefore it is necessary to classify these papers into groups. These groups are preferentially attribute groups or fields of application. The process of classification is done in step two of database assembly workflow. In addition to doing a literature study we also try to take commercial software packages into account. Often, commercial software packages use different names for the same attributes and these attributes work as a black box. Therefore it is difficult for the user to see what kind of attribute is working behind the functionality of the software. As a consequence to this we tried to identify the algorithms used in the software packages and to associate these attributes with the attributes described by literature.

The second part for the creation of an attribute database is the definition of groups or classes within the attributes. The problems that occur when dealing with classification are on the one hand the number of categories and on the other hand what can be used from previous works on classification. As an initial step we decided to keep close to works by Taner (1994, 2001), and Chopra and Marfurt (2005, 2008). The papers are classified in twelve main attribute groups. These groups include categories like coherence, curvature, spectral decomposition, or the application. To enhance the results from our queries it is important to subdivide the twelve main attribute groups in minor attributes. We came up with 152 minor attributes. As an example, for the main group “Coherence” we have nine minor attributes, which include cross-correlation based coherence (Bahorich & Farmer, 1995), semblance-based coherence (Marfurt et al., 1998), eigenstructure-based coherence (Gerszenkorn & Marfurt, 1999), or least squares-based coherence (Bednar, 1995). Additionally, each entry in the attribute database contains metadata, like the names of all authors, journal, year of publication, or the abstract.

The third and last part in assembling of an attribute database is the creation of queries (see figure 2). We decided to use five types of queries in our database. The first type is a simple dropdown possibility, where the user can take any of the twelve main or 152 minor attributes. The second query type is a dropdown possibility for the twelve main attributes, followed by a dropdown possibility for their accompanying minor attributes. The third query type is a dropdown possibility for the field of application in combination with a dropdown possibility for any seismic attribute. The fourth query is the so called software query, where the user can take one common attribute name and the database returns the synonym for this attribute used in commercial software packages. The last query
possibility is a key word search within the metadata (name of author, year of publication, name of journal, title, or abstract).

**Figure 1** Workflow for assembling a seismic attribute database. The workflow is divided into three steps. The Literature step (green), the Classification step (orange), and the Queries step (blue). The first step includes a literature study and a detailed study on attributes available in commercial software packages. In the second step all papers are classified using a classification scheme of twelve main attributes groups and 152 minor attributes. In this step also metadata (e.g. title, author(s), year of publication, journal, ...) is fed into the database. And finally in the third step various queries are constructed.

As output from all these queries the user gets a table containing the findings of an AND operation. This output table consists of a column containing the title, the first author, and the year of publication for each result of the AND operation (see figure 3). In addition to that also a select button is put next to each title in the list. By highlighting this select button for several papers and by pushing the print button it is possible to generate a reference list. The reference list of this paper is created by this workflow. At the moment the rules for the reference list is according to the First Break standards, but for future versions of the attribute database we will also include other standards.

At the moment the attribute database is created with Microsoft Access 2010. This means that the user of the database needs to have Access installed on his computer. For future releases of the database we are working on an online version of this database. This means that the database will be on a homepage and the user does not necessary need Access on his computer.
Figure 2 Overview on the query types available in the current version of the database. The first query type is the general case where each main or minor attribute can be selected. The second query type is the combination of one main attribute group and their accompanying minor attributes. The third query type is the combination of the field of application together with any seismic attribute. The fourth query type gives the relationship between names of attributes in commercial software packages and their common names as described in literature. The fifth and last type gives the possibility to do keyword search. This can be the name of the author, year of publication, title, within the abstract, or the journal. Based on these queries an output table is created. The output table contains information on title, first author, and year of publication. In the output table several papers can be selected and a reference list based on the First Break standards can be created.

One important issue for such a database is regular updating. The first version of the database was ready in July 2011, since then we have updated the database once. This update includes modifications on the functionality of the database, as well as inserting new papers and abstracts into the database. In the future we plan to update the database and its functionality regularly (preferentially on a yearly basis).

Figure 3 Output table after applying one of the query types. The first column contains select boxes. Articles where the select box is highlighted are used for the output of a reference list. The second column gives the titles of each paper. The third column gives the names of the corresponding (first) author for each paper. The fourth column gives the year of publication. It is possible to sort the output table by columns two to four.
Conclusion

Finally, we can conclude that the seismic attribute database gives us a huge benefit for knowledge of generating seismic attributes and their applications. With the database it is possible to quickly get information on certain attributes. This information includes general information as the algorithm working behind the attributes, or the principal application of these attributes. The application of seismic attributes is one of the key facts. With the help of the database we can easily get many case studies on certain fields of applications. If we think of a specific attribute we can refine the results for the field of application by using this seismic attribute as second input parameter for the query. Another important benefit from the seismic attribute database is the possibility to get the synonyms for specific attributes used in commercial software packages. Overall we can say that with the help of the seismic attribute database we can finally get the general overview on seismic attributes and their applications. We can easily create queries for our interpretation target and as a result we get a reference list for a large part of overall available papers dealing with this topic. This leads to the key take-away, saving money by time effective literature research.

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References


