An effective G&G exploration strategy inspired by a wolfpack

Nina Marie Hernandez, Francois Baillard, Kim Gunn Maver (Iraya Energies)

Introduction

New ventures efforts in a new area usually takes months or even years to fully understand and grasp the knowledge of a given area. The effort is usually articulated around the following questions 1. How much work has been done in the past? 2. How much can I leverage the current knowledge to avoid repeating the same work over and over again? 3. How can I best visualize the knowledge of a given area? 4. How can I ensure the knowledge will remain within the organization?

In this paper we investigate how today's analytical tools and machine learning automatic extraction of unstructured data can help maximize the most precious resource among geoscientists, time. We will be looking into similarities between a pack of wolves and a set of final well reports and illustrate how this concept can be utilized during a new ventures effort.

Unstructured data platform

In this case, we are currently looking at a study including over 30,000 documents covering over 150 wells in an exploration area. The data has been provided in an unstructured manner including final well reports, completion reports, drilling reports, seismic processing and acquisition reports to mention some. The files are commonly in .pdf, .docx, .xlsx and .pptx formats.

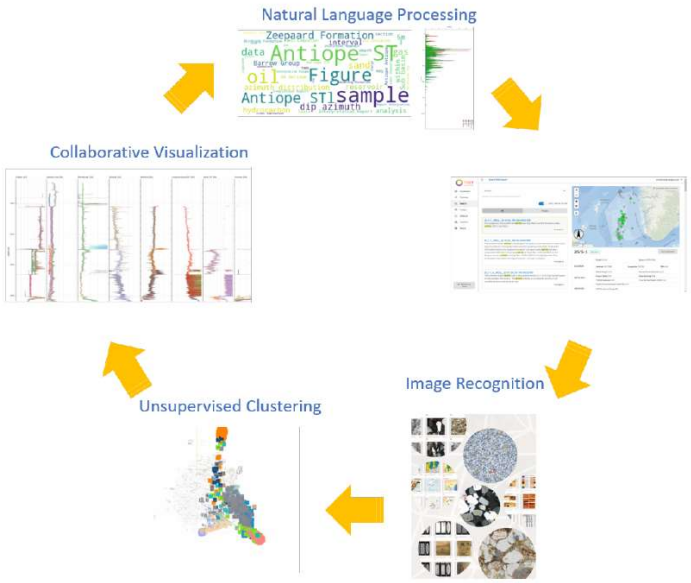

Figure 1: Workflow for data crushing with ElasticDocs

All the data is ingested through a consecutive pipeline and workflows using machine learning techniques such as NLP or deep CNN to provide the user with a structured set of data including metadata, index of documents, search through text and image corpus capabilities (Hernandez et al., 2019). Figure 1 summarizes the applied workflow for each document.

The final data can then be interrogated through the platform functionalities. One example of such interrogation will be a knowledge graph of the full documents database, providing a bird view of depencies and connectivities among them.

Knowledge graph

A knowledge graph is a powerful tool to visualize dependencies between wells and understand the prior knowledge of a given area. A knowledge graph can be constructed by interrogating every single well in the database and questionning whenever or not this well is correlated with a well within the database. An example of such knowledge graph can be visualized on Figure 2 where each node corresponds to a given well and the thickness of the link connected two wells illustrates the level of dependency between the two wells.

Figure 2 Knowledge graph showing correlation between wells

Similarities with a wolfpack

Similarly to a wolfpack the knowledge graph displayed on Figure 2 shows a level of hierarchy and organization among his constituants. Therefore, we could identify the following constitutants:

- The “sole spirit(s)”: these wells are most of the time alone and not connected to the rest of the graph.
- The “alpha(s)”: these wells are in the centre of the pack, they are essential for the understanding of the cluster, highly connected to the rest of the cluster. They provide a good analogue to the rest of the pack.
- The “scout(s)”: these wells connect two different clusters. They provide an essential link between clusters, region, basins.
- The “pack”: these wells are part of a cluster of the wells without any particular distinction.

Such a classification provides the geoscientist with a new insight on where to focus his exploration effort.

Conclusion

In this paper, we have shared an example of the use of a knowledge graph, showing the analogy with a wolfpack and introduced a classification allowing the geoscientist to prioritize some of the wells for his study such as “alpha(s)” for good analogues for a given area or “scout(s)” to connect distinct region-areas.

Combined with ElasticDocs, the knowledge graph provides an efficient tool for geoscientist to finally see the (unstructured) data, allowing the best use of his time and ultimately for a better and faster decision-making process.

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References

Hernandez N., Lucañas P., Graciosa J.C., Mamador C., Panganiban L. C. I.: Automated Information Retrieval from Unstructured Documents Utilizing a Sequence of Smart Machine Learning Methods within a Hybrid Cloud Container. EAGE Workshop on Big Data and Machine Learning for E&P Efficiency 25 - 27 February 2019.