



أرامكو السعودية
saudi aramco



An overview of natural language processing driven approaches toward assisted formation evaluation interpretation

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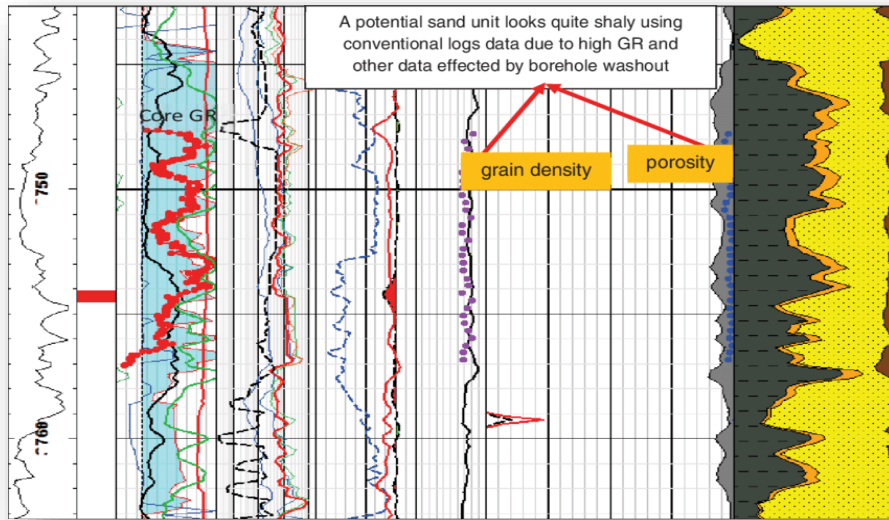
OG4IR/ICSNC 2020

where energy is opportunity™

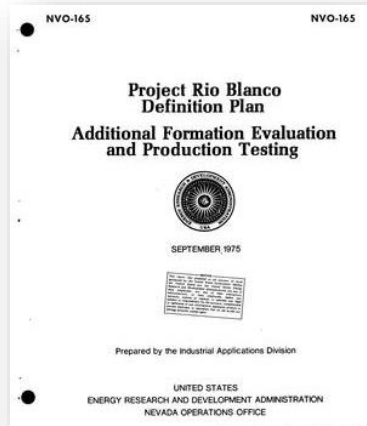
Biography - Klemens Katterbauer

- AI/Robotics Specialist at Saudi Aramco
- PhD, King Abdullah University of Science & Technology
- Focusing on artificial intelligence for deep reservoir monitoring
- Robotics for subsurface downhole evaluation

Background - Formation evaluation



Example of well log section



Formation evaluation report

Focus area

- Formation evaluation deals with the analysis of borehole data
- Objective is to determine the lithology, saturation zones, and productivity

Data

- Considerable amount of data available for interpretation
- Most critical information is available in the form of unstructured data (written reports & presentations, manuals)
- Considerable difference in the quality of data between different well logs and wells

Challenges in Formation Evaluation

Interpretation

- Interpretation of data may depend on the individual person
- Lack of/failure to take into account prior or complementary information

Data quality

- Data measurements may be in harsh environments creating lots of noise
- Measurement precision and quality may differ in time due to improvements in technology

Unstructured Data

- Substantial amount of critical data insight stored in reports and interpretations
- Extraction and interpretation of information very complex and challenging

Natural Language Processing (NLP)



Definition

- Focuses on interaction between computers and humans with natural language
- Transition from symbolic NLP over to Statistical and Neural NLP

Application areas

- Machine Translation
- Information Retrieval
- Sentiment Analysis
- Information Extraction
- Question and Answering

NLP Tasks Overview

Text and speech processing	Optical character recognition
	Speech segmentation
	Word segmentation
Morphological analysis	Part-of-speech tagging
	Lemmatization
Syntactic analysis	Sentence breaking
	Parsing
Lexical semantics	Lexical semantics
	Named entity recognition (NER)
Relational semantics	Relationship extraction
	Semantic Role Labeling
Discourse	Discourse analysis
	Topic segmentation and recognition
Higher-level NLP applications	Automatic summarization
	Question answering
	Natural language understanding

NLP in Formation Evaluation - Speech Recognition



Controlling well logging tools via voice

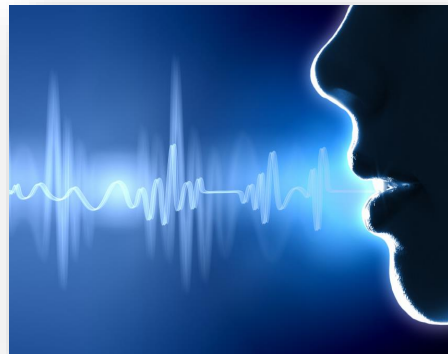
NLP in Formation Evaluation - Semantic Entity Recognition

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
WELL LOG SHEET - FORM NO. 1000
Log No. W-1000-1000

Well Name: ...
Location: ...
Date: ...
Operator: ...

Depth	Interval	Remarks	Color	Notes
0	0-10
10	10-20
20	20-30

Text and speech



- Reservoir 1
- Reservoir 2

Reservoir

- Resistivity
- Acoustic
- NMR Log

Well Log

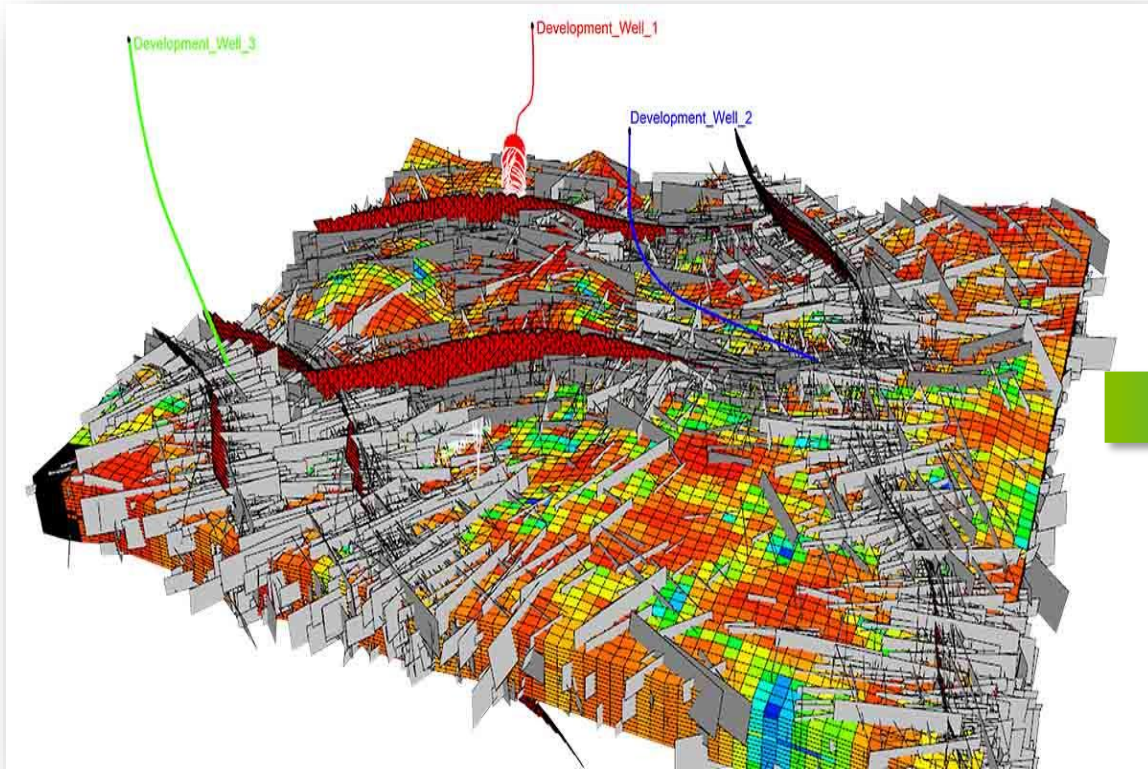
- Shale
- Sandstone
- Carbonate

Lithology

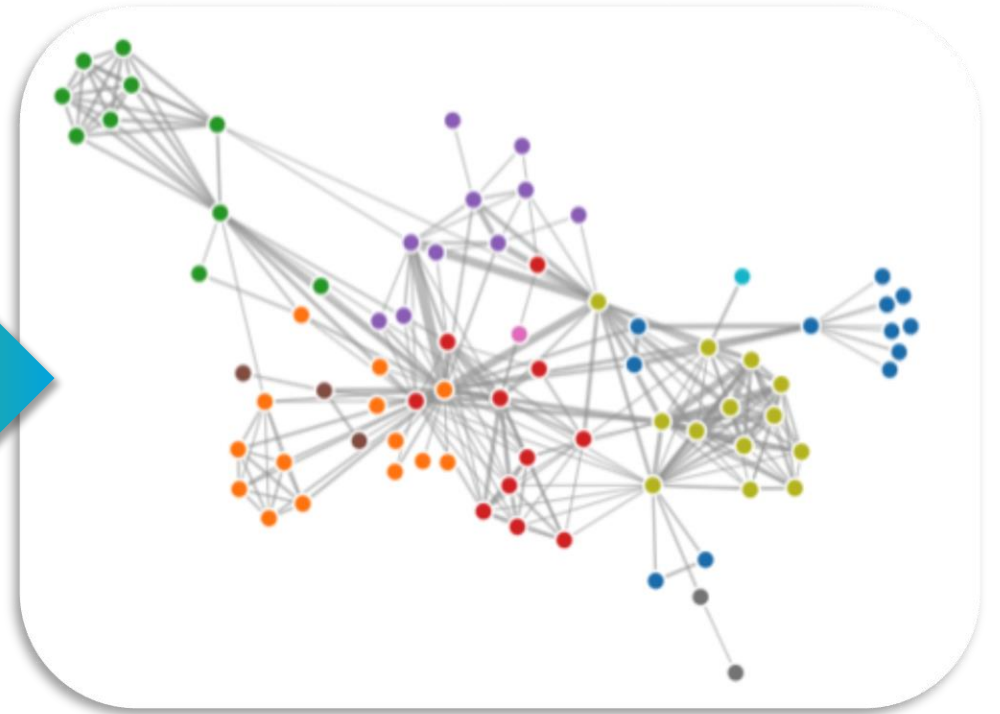
Physical and conceptual entities

Understanding of human-perceived concepts

NLP in Formation Evaluation - Relationship extraction

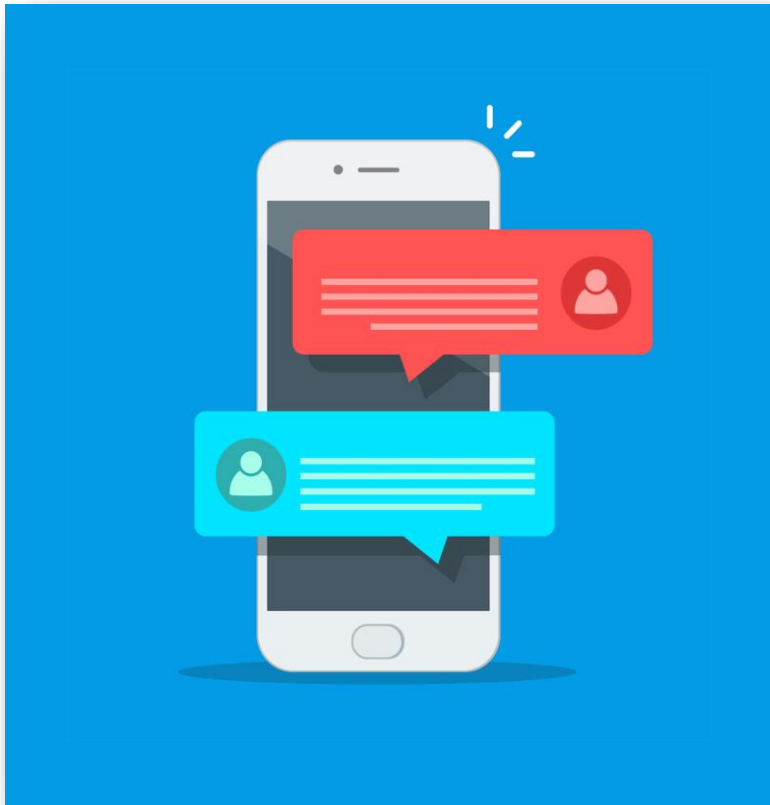


**Verbally interpreted
fracture network**



Relationship tree

NLP in Formation Evaluation - Question Answering - Chatbot



**Chatbot for information retrieval
and well log interpretation
recommendations**



**Assisted well log
interpretation**

Conclusions



Natural language processing provides a the opportunity to increase efficiency, enhance safety and improve well log interpretation quality

Voice-controlled operation of well logging tools

Significant opportunities for the utilization of NLP in formation evaluation