

Reservoir Engineering and Machine Learning Papers

Extracting 2-gram words from the papers

Load paper object from OnePetro scan

We do not do the scan here to save time. The paper scan to OnePetro was done in another notebook.

```
library(petro.One)
library(RWeka)
library(tm)
library(qdap)
library(tidyverse)
library(wordcloud)
library(knitr)
library(kableExtra)

# load previous findings
load(file = paste0("rese_rese_mach_mach", ".rda"))
papers <- paper_search_obj$papers
papers
```

```
# A tibble: 900 x 7
  book_title      paper_id dc_type authors      year source keyword
  <fct>          <fct>    <fct> <chr>         <int> <fct> <chr>
1 Application of ~ OTC-2863~ confer~ Pankaj, Piy~ 2018 OTC   'reservoi~
2 Reservoir Uncer~ SPE-1810~ confer~ Ani, Mauree~ 2016 SPE   'reservoi~
3 Contribution of~ SPE-1916~ confer~ Mohaghegh, ~ 2018 SPE   'reservoi~
4 Application of ~ SPE-1940~ confer~ Nande, Soum~ 2018 SPE   'reservoi~
5 Characterizatio~ SPE-1917~ confer~ Klenner, Ro~ 2018 SPE   'reservoi~
6 Inverse Modelin~ SPE-1800~ confer~ Tarrahi, Mo~ 2016 SPE   'reservoi~
7 Machine Learnin~ SPE-1800~ confer~ Shadravan, ~ 2016 SPE   'reservoi~
8 Machine Learnin~ SPE-1923~ confer~ Khan, Moham~ 2018 SPE   'reservoi~
9 Intelligent Cem~ CMT-440~ confer~ Shadravan, ~ 2015 CMT   'reservoi~
10 Using Machine-L~ SPWLA-20~ confer~ Bize-Forest~ 2018 SPWLA 'reservoi~
# ... with 890 more rows
```

Create corpus for paper titles

```
# this time we will remove all punctuation, all whitespaces, convert to lowercase,
# without stemming

data("stopwords") # remove custom stopwords
vdocs <- VCorpus(VectorSource(papers$book_title))

vdocs <- tm_map(vdocs, content_transformer(tolower)) # convert to lowercase
# vdocs <- tm_map(vdocs, removeNumbers) # if we remove numbers, CO2, 3D won't be recognized

vdocs <- tm_map(vdocs, removePunctuation) # remove all punctuation
vdocs <- tm_map(vdocs, stripWhitespace) # remove whitespaces
```

```
vdocs <- tm_map(vdocs, removeWords, stopwords("english")) # remove built-in stopwords
vdocs <- tm_map(vdocs, removeWords, custom_stopwords)

vdocs <- tm_map(vdocs, stemDocument, language = "english") # apply stemming
```

Analysis on two-words

```
options(mc.cores=1)

twogramTokenizer <- function(x) {
  NGramTokenizer(x, Weka_control(min = 2, max = 2))
}

tdm2 <- TermDocumentMatrix(vdocs,
                           control = list(tokenize = twogramTokenizer))

tdm2.matrix <- as.matrix(tdm2)
tdm2.rs <- sort(rowSums(tdm2.matrix), decreasing = TRUE)
tdm2.df <- data.frame(word = names(tdm2.rs), freq = tdm2.rs, stringsAsFactors = FALSE)

row.names(tdm2.df) <- NULL
tdm2_df <- head(tdm2.df, 60)

kable(
  list(
    tdm2_df[1:20, ], tdm2_df[21:40, ], tdm2_df[41:60, ]
  ),
  booktabs = TRUE,
  row.names = FALSE
)
```

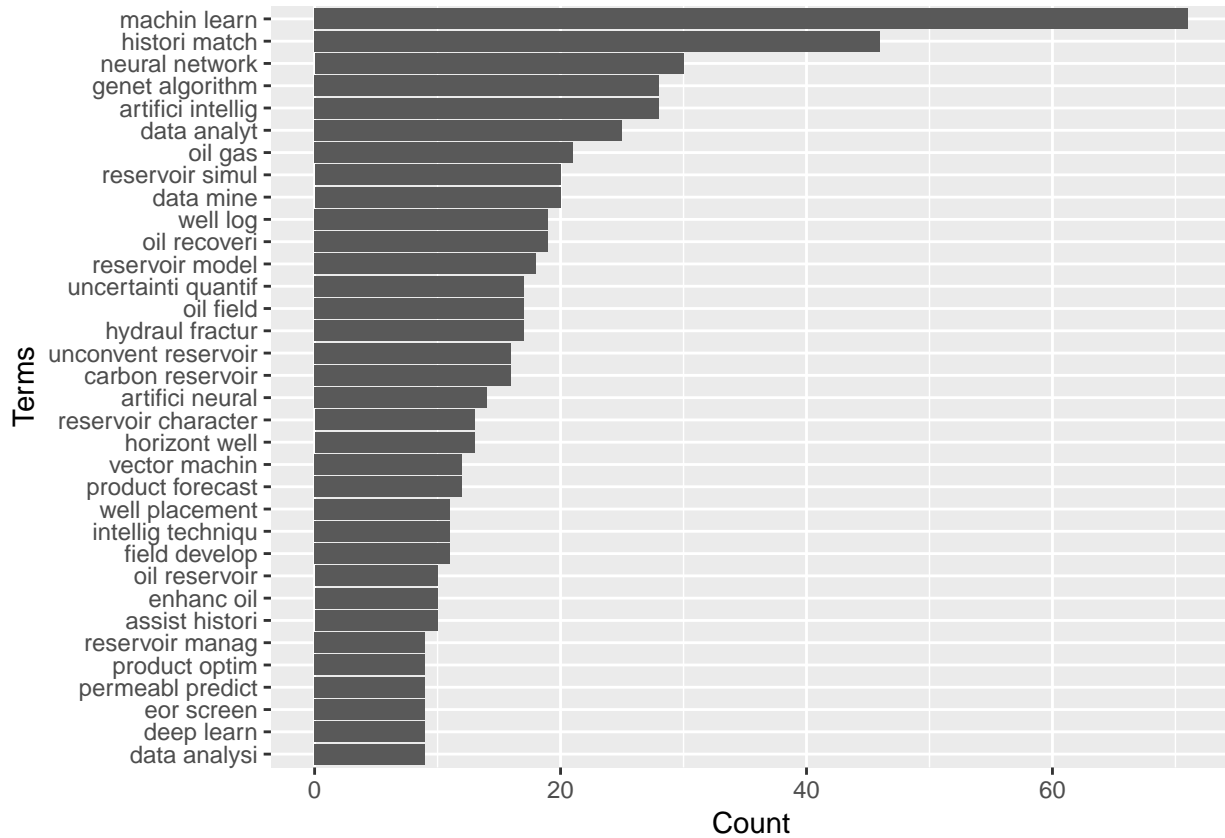
Plots on raw data

```
# we change the minimum frequency of appearance otherwise will be too crowded
set.seed(1234)
wordcloud(words = tdm2.df$word, freq = tdm2.df$freq, min.freq = 8,
          max.words=200, random.order=TRUE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"), font = 2)
```



```
p2 <- ggplot(subset(tdm2.df, freq > 8), aes(x=reorder(word, freq), y=freq)) +
  geom_bar(stat = "identity") +
  xlab("Terms") + ylab("Count") +
  coord_flip()
```

p2



We see many words that are not directly related to the *reservoir engineering* discipline. We will remove them by first creating a vector of **common stop words**. We split in three groups: data analytics stop words, common or geographical terms, and those terms not in the RE discipline, such as *electro submersible pumps*.

Refining the results

Additional custom stop words

```
dataanalytics <- c(
  "machin learn",
  "artifici intellig",
  "genet algorithm",
  "data analyt",
  "data mine",
  "data driven",
  "vector machin",
```

```

    "data analysi",
    "deep learn",
    "technolog focus",
    "pattern recognit",
    "datadriven model",
    "fuzzi logic",
    "kalman filter",
    "ensembl kalman",
    "optim techniqu",
    "neural network",
    "algorithm applic",
    "data manag",
    "data scienc",
    "datadriven method"
  )

common_terms <- c(
  "oil gas",
  "marcellus shale",
  "eagl ford",
  "oil field",
  "midland basin",
  "permian basin",
  "barnett shale",
  "crude oil"
)

not_in_discipline <- c(
  "ep note",
  "electr submers",
  "drill data",
  "well complet"
)

custom_stopwords_2 <- c(datalytics, common_terms, not_in_discipline)

```

Final Frequency table

```

# refine paper corpus by removing more stop words.
vdocs <- tm_map(vdocs, removeWords, custom_stopwords_2) # remove 2-grams

tdm2 <- TermDocumentMatrix(vdocs,
  control = list(tokenize = twogramTokenizer))

tdm2.matrix <- as.matrix(tdm2)
tdm2.rs <- sort(rowSums(tdm2.matrix), decreasing = TRUE)
tdm2.df <- data.frame(word = names(tdm2.rs), freq = tdm2.rs, stringsAsFactors = FALSE)

row.names(tdm2.df) <- NULL
tdm2_df <- head(tdm2.df, 60)

```

word	freq	word	freq	word	freq
histori match	46	reservoir manag	9	complex reservoir	5
reservoir simul	20	declin curv	8	data perman	5
oil recoveri	19	flow rate	8	faci classif	5
well log	19	unconvent well	8	gas reservoir	5
reservoir model	18	well perform	8	graviti drainag	5
hydraul fractur	17	candid select	7	interpret pressur	5
uncertainti quantif	17	placement optim	7	matur field	5
unconvent reservoir	17	shale gas	7	oil product	5
carbon reservoir	16	curv analysi	6	optim unconvent	5
horizont well	13	develop plan	6	optim well	5
reservoir character	13	digit oilfield	6	perform predict	5
product forecast	12	downhol gaug	6	predict reservoir	5
well placement	11	fractur reservoir	6	product analysi	5
assist histori	10	heavi oil	6	proxi model	5
enhanc oil	10	heterogen reservoir	6	reservoir fluid	5
field develop	10	multiphas flow	6	surveil optim	5
oil reservoir	10	perman downhol	6	well product	5
eor screen	9	seismic data	6	well test	5
permeabl predict	9	shale reservoir	6	composit reservoir	4
product optim	9	applic optim	5	declin analysi	4

```
kable(
  list(
    tdm2_df[1:20, ], tdm2_df[21:40, ], tdm2_df[41:60, ]
  ),
  booktabs = TRUE,
  row.names = FALSE
)
```

Word cloud

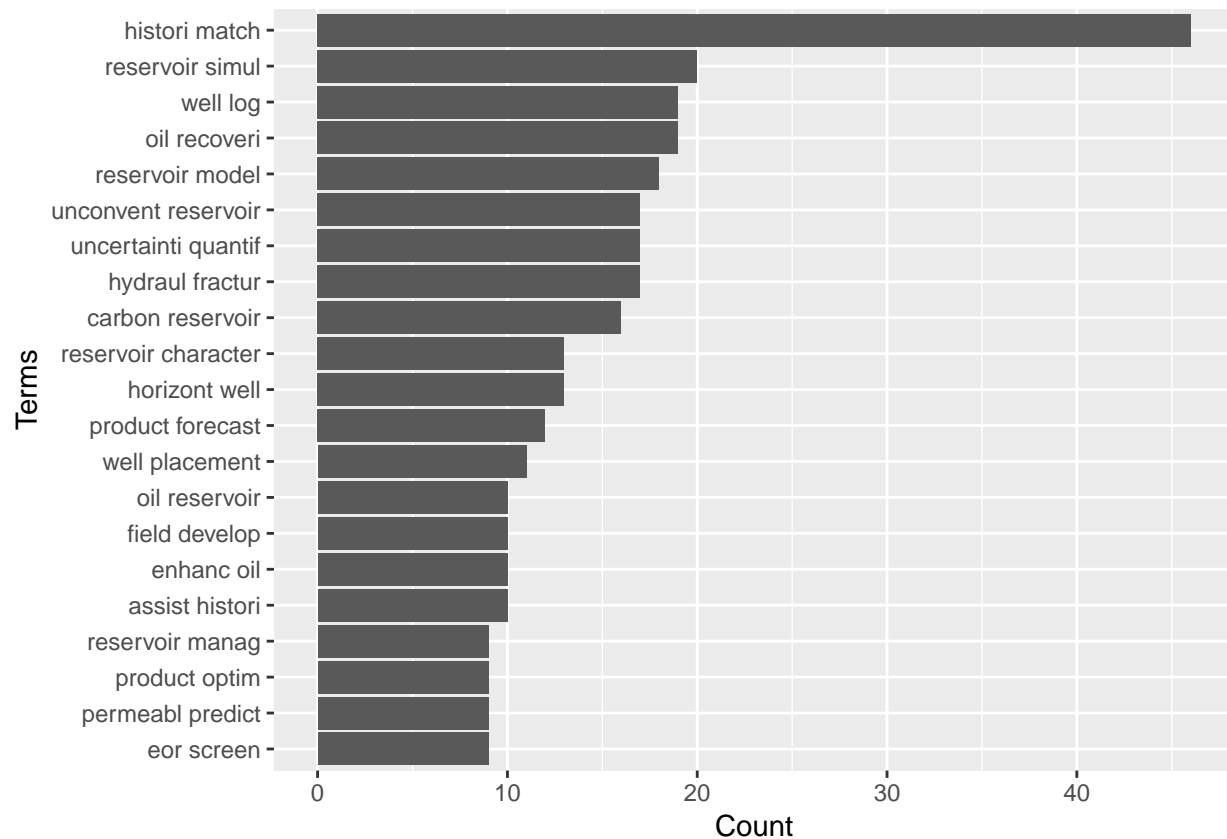
```
set.seed(1234)
wordcloud(words = tdm2.df$word, freq = tdm2.df$freq, min.freq = 8,
  max.words=200, random.order=TRUE, rot.per=0.35,
  colors=brewer.pal(8, "Dark2"), font = 2)
```



Bar plot

```
p2 <- ggplot(subset(tdm2.df, freq > 8), aes(x=reorder(word, freq), y=freq)) +  
  geom_bar(stat = "identity") +  
  xlab("Terms") + ylab("Count") +  
  coord_flip()
```

p2



Get papers for top 10 terms

```
top_papers %>%
  distinct(word, freq) %>%
  kable(booktabs = TRUE) %>%
  kable_styling(latex_options = "striped")
```

word	freq
histori match	46
reservoir simul	20
well log	19
oil recoveri	19
reservoir model	18
unconvent reservoir	17
uncertainti quantif	17
hydraul fractur	17
carbon reservoir	16
horizont well	13

Notice that we are using stemmed words, the root of the words. In the next table, the stemmed words are replaced by the complete words.

Report

```
top_papers %>%
  select(book_title, paper_id) %>%
  mutate(book_title = substr(book_title, 1, 80)) %>%
  kable(booktabs = T, longtable = TRUE) %>%
  kable_styling(latex_options = c("striped", "repeat_header")) %>%
  group_rows("history matching", 1, 46) %>%
  group_rows("reservoir simulation", 47, 66) %>%
  group_rows("well logging", 67, 85) %>%
  group_rows("oil recovery", 86, 104) %>%
  group_rows("reservoir modeling", 105, 122) %>%
  group_rows("unconventional reservoirs", 123, 139) %>%
  group_rows("uncertainty quantification", 140, 156) %>%
  group_rows("hydraulic fracturing", 157, 173) %>%
  group_rows("carbonate reservoirs", 174, 189) %>%
  group_rows("horizontal wells", 190, 202)
```

book_title	paper_id
history matching	
Integration of PCA with a Novel Machine Learning Method for Reparameterization a	SPE-175038-MS
Video: Integration of PCA with a Novel Machine Learning Method	SPE-175038-PT
Pattern-Based History Matching for Reservoirs with Complex Geologic Facies	SPE-190128-MS
A Model Segmentation from Spectral Clustering: New Zonation algorithm and Applic	SPE-170757-MS
History Matching With Learned Sparse Dictionaries	SPE-133654-MS
Assisted History Matching and Uncertainty Analysis by Geologically Consistent Sa	SPE-182749-MS
Optimization Methods for History Matching of Complex Reservoirs	SPE-66393-MS
Use Of Evolutionary Algorithms In Single And Multi- Objective Optimization Techn	OMC-2009-079
Event Targeting Model Calibration Used for History Matching Large Simulation Cas	SPE-106044-MS
Reservoir Simulation Assisted History Matching: From Theory to Design	SPE-182808-MS
Importance of Using Pressure Data While History Matching a Waterflooding Process	SPE-132347-MS
Next Generation of Workflows for Multilevel Assisted History Matching and Produc	SPE-167340-MS
Model Selection for Error Generalization in History Matching	SPE-190778-MS
Combined Global and Local Optimization Techniques Applied to History Matching	SPE-79668-MS
A New History Matching Sensitivity Analysis Framework with Random Forests and Pl	SPE-189265-MS
Estimation of Distribution Algorithms Applied to History Matching	SPE-141161-PA
Application of Particle Swarms for History Matching in the Brugge Reservoir	SPE-135264-MS
Data Driven Adaptive Localization With Applications To Ensemble-Based 4D Seismic	SPE-185936-MS
Probabilistic Performance Forecasting in History Matching of Low Permeability Re	SPE-188100-MS
Correlation-Based Adaptive Localization With Applications to Ensemble-Based 4D-S	SPE-185936-PA
Estimating Scale Deposition Through Reservoir History Matching in the Janice Fie	SPE-164112-PA
Estimation of Distribution Algorithms Applied to History Matching	SPE-141161-MS
Dynamic Penalty Function Evolution Algorithms for History Matching of Oil and Ga	SPE-163372-MS
Produced-Water-Chemistry History Matching in the Janice Field	SPE-164903-PA
Assisted History Matching of Channelized Models by Use of Pluri-Principal-Compon	SPE-173192-PA
On Optimal Selection of Objective Grouping for Multiobjective History Matching	SPE-185957-PA
Sparse Geologic Dictionaries for Field-Scale History Matching Application	SPE-173275-MS
Assisted History Matching Using Pattern Recognition Technology	SPE-173405-MS
A Physics-Based Data-Driven Model for History Matching, Prediction, and Characte	SPE-191126-PA
Video: A Model Segmentation from Spectral Clustering: New Zonat	SPE-170757-PT
Geologically Consistent History Matching of a Deepwater Turbidite Reservoir	SPE-95557-MS
A Practical Data Integration Approach to History Matching: Application to a Deep	SPE-95557-PA

(continued)

book_title	paper_id
An Efficient Probabilistic Assisted History Matching Tool Using Gaussian Process	SPE-191655-MS
Produced-Water-Chemistry History Matching Using a 1D Reactive Injector/Producer	SPE-164113-PA
Advanced Reservoir Management Workflow Using an EnKF Based Assisted History Matc	SPE-118906-MS
A Parallelized and Hybrid Data-Integration Algorithm for History Matching of Geo	SPE-175039-PA
An Ensemble Based Nonlinear Orthogonal Matching Pursuit Algorithm for Sparse His	SPE-163582-MS
A Practical Workflow for Probabilistic History Matching and Forecast Uncertainty	SPE-181639-MS
Holistic Workflow for Autonomous History Matching using Intelligent Agents: A Co	SPE-143842-MS
Data-Driven Metric Learning for History Matching	SPE-182683-MS
Applying Support Vector Regression to Reduce the Effect of Numerical Noise and E	SPE-187430-MS
Hybrid Optimization coupling EnKF and Evolutionary Algorithms for History Matchi	SPE-121965-MS
Data Assimilation Coupled to Evolutionary Algorithms—A Case Example in History M	SPE-125512-MS
Prior Model Identification with Sparsity-Promoting History Matching	SPE-163652-MS
A Surrogate-based Adaptive Sampling Approach for History Matching and Uncertaint	SPE-173298-MS
Integration of Ensemble Data Assimilation and Deep Learning for History Matching	OTC-28015-MS
reservoir simulation	
Sampling From the Posterior in Reservoir Simulation	SPE-188892-MS
Reservoir Simulation Assisted History Matching: From Theory to Design	SPE-182808-MS
Probabilistic Uncertainty Quantification of a Complex Field Using Advanced Proxy	SPE-182637-MS
Grid-Based Surrogate Reservoir Modeling (SRM) for Fast Track Analysis of Numeric	SPE-153844-MS
Identification of the Compositional Path Followed During Reservoir Simulation Im	SPE-180124-MS
A Black-Box Interpolation Method To Accelerate Reservoir Simulation Solutions	SPE-163614-MS
High-Performance Modeling of Carbon Dioxide Sequestration by Coupling Reservoir	SPE-163621-PA
Production Management Decision Analysis Using AI-Based Proxy Modeling of Reservo	SPE-170664-MS
Reservoir Simulation of Steam Fracturing in Early-Cycle Cyclic Steam Stimulation	SPE-129686-PA
Upscaling for Compositional Reservoir Simulation	SPE-173212-PA
Machine Learning Methods to Speed up Compositional Reservoir Simulation	SPE-154505-MS
A Hybrid Integrated Compositional Reservoir Simulator Coupling Machine Learning	SPE-192368-MS
A Benchmarking Study of a Novel Data Physics Technology for Steamflood and SAGD	SPE-189772-MS
Developing a Smart Proxy for the SACROC Water-Flooding Numerical Reservoir Simul	SPE-185691-MS
Reservoir Simulation Using Smart Proxy in SACROC Unit - Case Study	SPE-184069-MS
Reduced Order Modeling In Reservoir Simulation Using the Bilinear Approximation	SPE-169357-MS
Continuous Reservoir Simulation Model Updating and Forecasting Using a Markov Ch	SPE-119197-MS
A System for Continuous Reservoir Simulation Model Updating and Forecasting	SPE-107566-MS
Optimization of Unconventional Well-Pad Area Using Reservoir Simulation and Inte	URTEC-2673695-MS
Performance Evaluation in Data Rich Fayetteville Shale Gas Plays - Integrating P	IPTC-14940-MS
well logging	
Linear Coregionalization Modeling: Cross-Variogram for Multivariate Core Permeab	SPWLA-JFES-2017-AA
Synthetic Well Log Generation Using Machine Learning Techniques	URTEC-2877021-MS
Enhancing Rock Property Prediction from Conventional Well Logs Using Machine Lea	SPE-183106-MS
Accelerating and Enhancing Petrophysical Analysis With Machine Learning: A Case	SPWLA-2018-BB
Incorporation of experts' experience into machine learning models using well log	OIJ-2017-12-028-031-RU
New Data-Driven Method for Predicting Formation Permeability Using Conventional	SPE-182826-MS
Applying Statistical Learning to Quantitative Well Log Analysis	SPE-186044-MS
Integrating Core Porosity and Well Logging Interpretations for Multivariate Perm	OTC-28764-MS
Permeability Prediction from Wireline Well Logs Using Fuzzy Logic and Discrimina	SPE-133209-MS
Video: Maximizing Information through Data Driven Analytics in	SPE-174735-PT
Maximizing Information through Data Driven Analytics in Petrophysical Evaluation	SPE-174735-MS
Petrophysical Well Log Analysis through Intelligent Methods	SPE-185922-MS
Video: Integrating Core Porosity and Well Logging Interpretatio	OTC-28764-PT
The Role of Electrofacies, Lithofacies, and Hydraulic Flow Units in Permeability	SPE-84301-PA

(continued)

book_title	paper_id
A Genetic Algorithm/neural Network Approach to Seismic Attribute Selection For W	SEG-2002-1654
Clustering-Based Optimal Perforation Design Using Well Logs	SPE-177282-MS
Drilling Data Provide Solution to Horizontal Well Log Costs	SPE-0815-0035-JPT
Permeability and Porosity From Integrated Multiattributes and Well Log Data Usin	SEG-2013-0376
Application of Artificial Intelligent Techniques to Determine Sonic Time from We	ARMA-2016-755
oil recovery	
Capacity Assessment of CO2 Storage and Enhanced Oil Recovery in Residual Oil Zon	SPE-191604-MS
Improved Oil Recovery Estimation with Data Analytic Methods: A Workflow for Open	SPE-185740-MS
Sensitivity Analysis for Solar-Generated Steam for Enhanced Oil Recovery	SPE-190075-MS
An Extensive Review on the Effective Sequence of Heavy Oil Recovery	SPE-157864-MS
Screening Strategy for Chemical Enhanced Oil Recovery in Wyoming Basins	SPE-115940-MS
An Alternate Simplified Approach For Selecting Enhanced Oil Recovery Technolog	SPE-144982-MS
Evaluation of Enhanced Oil Recovery Technologies for the Sabriyah Lower Burgan R	SPE-186026-MS
Uncertainty Quantification of Forecasted Oil Recovery using Dynamic Model Rankin	IPTC-17476-MS
Application of a Hybrid System of Genetic Algorithm & Fuzzy Logic as Optimizatio	SPE-149982-MS
Hybrid Process of Gas and Downhole Water Sink-Assisted Gravity Drainage (G&DWS-A	CMTC-502487-MS
Improved Oil Recovery Methods: Applicability Screening and Potential Evaluation	SPE-134742-MS
Surfactant Versus Solvent Co-Injection to Improve Efficiency of Steam Assisted B	SPE-190119-MS
Design and Development of Data-Driven Screening Tools for Enhanced Oil Recovery	SPE-190028-MS
An Experimental Study of Imbibition Oil Recovery from Oil-Wet Shales	SPE-190044-MS
Adopting Simple & Advanced Genetic Algorithms as Optimization Tools for Increasi	SPE-140538-MS
Novel Approach to Predict Potentiality of Enhanced Oil Recovery	SPE-99261-MS
The Use of an Operational Filter Boosted Artificial Neural Network for Selection	SPE-175864-MS
Geomechanical Study of Bakken Formation For Improved Oil Recovery	ISRM-SINOROCK-2009-0
Integrated Screening Criteria for Offshore Application of Enhanced Oil Recovery	SPE-170795-MS
reservoir modeling	
Grid-Based Surrogate Reservoir Modeling (SRM) for Fast Track Analysis of Numeric	SPE-153844-MS
Candidate Selection Using Stochastic Reasoning Driven by Surrogate Reservoir Mod	SPE-136373-PA
Automated Reservoir Model Selection in Well Test Interpretation	SPE-71569-MS
Spatial-Temporal Tensor Decompositions for Characterizing Control-Relevant Flow	SPE-173238-MS
Dynamic Penalty Function Evolution Algorithms for History Matching of Oil and Ga	SPE-163372-MS
Development of Reduced-order Oil Reservoir Models using Localized DEIM	SPE-170741-MS
Rapid Reservoir Modeling With Automated Tops Correlation	URTEC-2904037-MS
Fast Integrated Reservoir Modelling on the Gjøa Field Offshore Norway	SPE-188557-MS
Gaussian Process for Uncertainty Quantification of Reservoir Models	SPE-176074-MS
Uncertainty Reduction In Reservoir Modeling By Joint Inversion of Seismic & Geo-	SEG-2008-0829
An Integrated Reservoir Modelling and Evolutionary Algorithm for Optimizing Fiel	SPE-183178-MS
Produced-Water-Chemistry History Matching Using a 1D Reactive Injector/Producer	SPE-164113-PA
Markov-Chain Monte Carlo with Locally Varying Mean Kriging for Improved Reservo	SPE-180189-MS
Reservoir Modelling with Feature Selection: Kernel Learning Approach	SPE-141510-MS
Apply Two-Way Cluster Analysis to Select Candidate Reservoir Models From Multipl	SPE-179955-MS
Approximation of Multi-Fractured Horizontal Well Composite Reservoir Models Usin	URTEC-2697557-MS
An Ensemble Based Nonlinear Orthogonal Matching Pursuit Algorithm for Sparse His	SPE-163582-MS
Application of Well-Base Surrogate Reservoir Models (SRMs) to Two Offshore Field	SPE-153845-MS
unconventional reservoirs	
Data Analytics for Production Optimization in Unconventional Reservoirs	URTEC-2167005-MS
Effective Applications of Extended Exponential Decline Curve Analysis to both Co	SPE-181536-MS
A Novel Workflow for Fracture Reconstruction and Uncertainty Analysis for Unconv	SPE-191795-MS
Combining Physics, Statistics and Heuristics in the Decline Curve Analysis of La	SPE-185589-MS
Characterization of Anisotropic Elastic Moduli and Stress for Unconventional Res	SPE-175907-PA

(continued)

book_title	paper_id
Combining Physics, Statistics, and Heuristics in the Decline-Curve Analysis of L	SPE-185589-PA
Myths and Facts of Forecasting Horizontal Well Production in Unconventional Rese	URTEC-2897088-MS
A Physics-Based Data-Driven Model for History Matching, Prediction, and Characte	SPE-191126-PA
Efficient Use of Data Analytics in Optimization of Hydraulic Fracturing in Uncon	SPE-177549-MS
Modeling Early Time Rate Decline in Unconventional Reservoirs Using Machine Lear	SPE-188231-MS
Enhancing Rock Property Prediction from Conventional Well Logs Using Machine Lea	SPE-183106-MS
Functional Approach to Data Mining, Forecasting, and Uncertainty Quantification	SPE-174849-MS
Performance Prediction for Advanced Well Structures in Unconventional Oil and Ga	SPE-187037-MS
Steps for Improving the Utility of Land Seismic Data for Unconventional Reservoir	URTEC-2901978-MS
Application of Data Analytics for Production Optimization in Unconventional Rese	URTEC-2670157-MS
An Unsupervised Learning Algorithm To Compute Fluid Volumes From NMR T1-T2 Logs	SPWLA-2018-Y
Unlocking the Potential of Unconventional Reservoirs Through New Generation NMR	SPWLA-2017-v58n2a1
uncertainty quantification	
Bridging the Gap Between Deterministic and Probabilistic Uncertainty Quantificat	SPE-173301-MS
Multi-Objective Optimization with Application to Model Validation and Uncertaint	SPE-105313-MS
Probabilistic Uncertainty Quantification of a Complex Field Using Advanced Proxy	SPE-182637-MS
Uncertainty Quantification in Reservoir Performance Using Distances and Kernel M	SPE-118740-PA
Robust Uncertainty Quantification through Integration of Distributed Gauss-Newto	SPE-191516-MS
Continuous Reservoir-Simulation-Model Updating and Forecasting Improves Uncertai	SPE-119197-PA
Bayesian Optimization Algorithm Applied to Uncertainty Quantification	SPE-143290-PA
Functional Approach to Data Mining, Forecasting, and Uncertainty Quantification	SPE-174849-MS
Gaussian Process for Uncertainty Quantification of Reservoir Models	SPE-176074-MS
A New Probabilistic Approach for Uncertainty Quantification in Well Performance	SPE-183651-PA
Uncertainty Quantification of Forecasted Oil Recovery using Dynamic Model Rankin	IPTC-17476-MS
A Practical Workflow for Probabilistic History Matching and Forecast Uncertainty	SPE-181639-MS
Functional Approach to Data Mining, Forecasting, and Uncertainty Quantification	SPE-1016-0067-JPT
Comparison of Stochastic Sampling Algorithms for Uncertainty Quantification	SPE-119139-PA
Comparison of Stochastic Sampling Algorithms for Uncertainty Quantification	SPE-119139-MS
A Surrogate-based Adaptive Sampling Approach for History Matching and Uncertaint	SPE-173298-MS
Uncertainty Quantification and Inverse Modeling of Fault Poromechanics and Induc	ARMA-2016-151
hydraulic fracturing	
Maximizing Tight Gas Recovery through a New Hydraulic Fracture Optimization Mode	SPE-148205-MS
Optimizing Treatment Parameters for Enhanced Hydrocarbon Production by Hydraulic	PETSOC-03-06-02
Selection of Hydraulic Fracturing Candidates in Iranian Carbonate Oil Fields: A	IPTC-17192-MS
An Intelligent Hydraulic Fracture Optimization Model: A New Tool to Stimulate Lo	SPE-101137-MS
Efficient Use of Data Analytics in Optimization of Hydraulic Fracturing in Uncon	SPE-177549-MS
Using Machine Learning to Identify the Highest Wet Gas Producing Mix of Hydraul	URTEC-2430481-MS
Application of Data Mining Tools for Analysis and Prediction of Hydraulic Fractu	SPE-171332-RU
Application of Data Mining Tools for Analysis and Prediction of Hydraulic Fractu	SPE-171332-MS
Development of a Fuzzy System Model for Candidate-well Selection for Hydraulic F	SPE-153200-MS
Designed Simulations for Optimization of Hydraulic Fracture Design and Productio	SPE-190835-MS
Analysis of Best Hydraulic Fracturing Practices in the Golden Trend Fields of Ok	SPE-95942-MS
Potential Thermoelastic and Poroelastic Stresses Effects During the Fracture Pro	ARMA-2018-859
Downturn Represents Stress Test for Unconventional Hydraulic Fracture Modeling	SPE-0216-0044-JPT
Hydraulic Fracturing Conference Offers New Insights	SPE-0317-0035-JPT
Qualifying Diversion in Multi Clusters Horizontal Well Hydraulic Fracturing in H	SPE-189850-MS
Evaluation and Prediction of Hydraulic Fractured Well Performance in Montney For	SPE-180416-MS
Acoustics-Based Flow Monitoring During Hydraulic Fracturing	SPE-179151-MS
carbonate reservoirs	
Using Machine-Learning for Depositional Facies Prediction in a Complex Carbonate	SPWLA-2018-NNNN

(continued)

book_title	paper_id
Modeling, Application, and Optimization of Engineered Water Injection Technology	SPE-194032-STU
Artificial-Intelligence Technology Predicts Relative Permeability of Giant Carbo	SPE-109018-PA
Fluid Type Identification in Carbonate Reservoir Using Advanced Statistical Anal	SPE-185447-MS
EOR Field Experiences in Carbonate Reservoirs in the United States	SPE-100063-PA
EOR Field Experiences in Carbonate Reservoirs in the United States	SPE-100063-MS
Optimising Gas Injection in Carbonate Reservoirs Using High-Resolution Outcrop A	SPE-166061-MS
Prediction of Reservoir Water Saturation Using Support Vector Regression in an I	ARMA-2013-311
Permeability Prediction in Carbonate Reservoirs using Specific Area, Porosity an	SEG-2014-0021
In situ Wettability Measurement in a Carbonate Reservoir Rock at High Temperatur	SPE-188510-MS
Uncertainty Quantification of Forecasted Oil Recovery using Dynamic Model Rankin	IPTC-17476-MS
Shear Wave Prediction in Carbonate Reservoirs: Can Artificial Neural Network Out	ARMA-2018-905
Development of a Fuzzy System Model for Candidate-well Selection for Hydraulic F	SPE-153200-MS
Performance Review and Field Measurements of an EOR-WAG Project in Tight Oil Car	SPE-171871-MS
A Systematic Approach on Nuclear Magnetic Resonance Petrophysical Solutions to o	SPE-188198-MS
Estimates of In Situ Stress and Faults/Fractures in Carbonate Reservoirs in Onsh	SPE-177520-MS
horizontal wells	
Myths and Facts of Forecasting Horizontal Well Production in Unconventional Rese	URTEC-2897088-MS
Enabling Autonomous Well Optimization Via Using IoT-Enabled Devices and Machine	SPE-190955-MS
High Resolution Seismic Data Derived From Prestack Inversion and Machine Learnin	URTEC-2695422-MS
A Large-Scale Study for a Multi-Basin Machine Learning Model Predicting Horizont	SPE-191538-MS
Automated Identification of Optimal Deviated and Horizontal Well Targets	SPE-192279-MS
Approximation of Multi-Fractured Horizontal Well Composite Reservoir Models Usin	URTEC-2697557-MS
A Modified Genetic Algorithm for Horizontal Well Placement Optimization in Gas C	SPE-135182-MS
A Hybrid Data-Driven and Knowledge-Driven Methodology for Estimating the Effect	SPE-191446-MS
Post-Frac-Hit Mitigation and Well Remediation of Woodford Horizontal Wells With	URTEC-2902400-MS
Partition Perforation Optimization for Horizontal Wells Based on Genetic Algorit	SPE-119833-PA
Drilling Data Provide Solution to Horizontal Well Log Costs	SPE-0815-0035-JPT
Qualifying Diversion in Multi Clusters Horizontal Well Hydraulic Fracturing in H	SPE-189850-MS
Hole-Cleaning Performance of Gasified Drilling Fluids in Horizontal Well Section	SPE-131378-PA

Sample of papers for Candidate Selection and Permeability Prediction

```
papers_2t <- get_top_term_papers(papers, tdm2.matrix,
                                terms = c("candid select"))
papers_2t %>%
  select(book_title, paper_id, authors) %>%
  mutate(book_title = substr(book_title, 1, 65)) %>%
  mutate(paper_id = substr(paper_id, 1, 14)) %>%
  mutate(authors = substr(authors, 1, 20)) %>%
  kable(booktabs = T, caption = "Candidate Selection") %>%
  kable_styling(latex_options = "striped")

papers_2t <- get_top_term_papers(papers, tdm2.matrix,
                                terms = c("permeabl predict"))
papers_2t %>%
  select(book_title, paper_id, authors) %>%
  mutate(book_title = substr(book_title, 1, 65)) %>%
  mutate(paper_id = substr(paper_id, 1, 14)) %>%
  mutate(authors = substr(authors, 1, 20)) %>%
  kable(booktabs = T, caption = "Permeability Prediction") %>%
```

Table 2: Candidate Selection

book_title	paper_id	authors
Candidate Selection Using Stochastic Reasoning Driven by Surrogat	SPE-136373-PA	Graf, Thomas, Schlum
Fact-Based Re-Frac Candidate Selection and Design in Shale - A Ca	URTEC-2433427-	Mohaghegh, Shahab D.
From Face Detection to Fractured Reservoir Characterization: Big	SPE-187328-MS	Udegbe, Egbadon, The
Smart and Automated Workover Candidate Selection	SPE-181072-MS	Zangl, Georg, myr:co
Deep Learning for Steam Job Candidate Selection	SPE-187339-MS	Cheung, Chung Ming,
Cyclic Steam Injection Modeling and Optimization for Candidate Se	SPE-185747-MS	Sarma, Pallav, Tachy
A Fast Semi-Analytical Method for Refracturing Candidate Selectio	URTEC-2693452-	Aniemena, Chigozie,

Table 3: Permeability Prediction

book_title	paper_id	authors
Normalized Depths as Key Input and Detailed QC Steps for Improved	SPE-188493-MS	Voleti, Deepak Kumar
Harnessing the Power of Type-2 Fuzzy Logic System to Achieve Impr	SPE-182745-MS	Olatunji, S. O., Col
Support-Vector Regression for Permeability Prediction in a Hetero	SPE-126339-PA	Al-anazi, Ammal F.,
Permeability Prediction in a Heterogeneous Reservoir Using Soft C	SPE-190078-MS	Zhao, Xiaoxi, Univer
Permeability Prediction in Carbonate Reservoirs using Specific Ar	SEG-2014-0021	Sitouah, M., Scumble
Permeability Prediction from Wireline Well Logs Using Fuzzy Logic	SPE-133209-MS	Nashawi, Ibrahim Sam
Improved Permeability Prediction From Seismic and Log Data using	SPE-164465-MS	Anifowose, Fatai A.,
The Role of Electrofacies, Lithofacies, and Hydraulic Flow Units	SPE-84301-PA	Perez, Hector H., Ec
Applying Artificial Intelligence Techniques to Develop Permeabili	SPE-168109-MS	Nooruddin, Hasan A.,

```
kable_styling(latex_options = "striped")
```