Reservoir and Non-reservoir Analysis

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Reservoir and Non-reservoir Analysis for Kipper 2

- Data collection
- Data transformation and reduction
- Basic statistic analysis
- Data mining methods
- Experimental results
- Conclusion and Future work

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Data Collection

- Integrate Kipper 2 oil well log data with reservoir data
- 16421 samples, randomly from 98 to 2600 meters
- Attributes: RHOB, DRHO, GAMMA, NPHI, SP, P_SONIC, LLD, LLS, MSFL, PEF, BS, CALI

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Goal

- Discover the patterns which discriminate the reservoir level and non-reservoir level

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Data Transformation and Reduction

- CALI has strong correlation with the target
- BS and PEF have little correlation with the target
- Delete BS, CALI and PEF
- Invalid values, e.g. -999.25
- 7322 samples from 1483 to 2598 meters
- 4183 in non-reservoir level, 3139 in reservoir level

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Basic Statistic Analysis

	DRHO	GAMMA	LLD	LLS	MSFL	NPHI	P_SONIC	RHOB
Mean	0.02613	54.67621	5.20074	4.529411	6.574453	0.29164	267.1608	2.353842
Median	0.0072	49.1891	3.0416	2.83365	2.68195	0.2807	289.315	2.35685
Maximum	13.6306	122.4205	142.2169	79.6575	1730.716	0.6747	491.1891	35.392
Minimum	-0.0621	12.3244	0.7535	0.6442	0.229	0.0277	-999.5	1.1458
Std. Dev.	0.274192	25.42418	7.670533	5.542583	41.76813	0.091635	179.0437	0.678153
Skewness	47.85782	0.346665	6.850942	5.161624	32.41849	0.658799	-6.49366	41.9647
Kurtosis	2339.785	1.888366	78.54362	47.68486	1154.316	3.768132	46.22627	1970.332
Observations	7322	7322	7322	7322	7322	7322	7322	7322

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Correlation Matrix

	DRHO	GAMMA	LLD	LLS	MSFL	NPHI	P_SONIC	RHOB
DRHO	1							
GAMMA	-0.01467	1						
LLD	0.016994	0.026518	1					
LLS	0.02471	0.112281	0.976011	1				
MSFL	-0.00573	0.010332	0.429801	0.419588	1			
NPHI	0.084569	0.145012	-0.2813	-0.26193	-0.04427	1		
P_SONIC	0.01322	-0.18671	-0.16514	-0.20935	-0.07786	0.220849	1	
RHOB	0.935245	0.090081	0.074813	0.095076	0.038695	-0.10811	-0.05879	1

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Data Mining

- Decision Tree, CHAID
- Include attributes -- RHOB, DRHO, GAMMA, NPHI, P_SONIC, LLD and LLS

Cross-validated(a)	Count	0	3751	432	4183
		1	460	2679	3139
	%	0	89.67248	10.32752	100
		1	14.65435	85.34565	100

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Data Mining

- Decision Tree, QUEST
- Include attributes -- RHOB, DRHO, GAMMA, NPHI, P_SONIC, LLD and LLS

Cross-validated(a)	Count	0	3814	369	4183
		1	582	2557	3139
	%	0	91.17858	8.82142	100
		1	18.54094	81.45906	100

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Experimental Results

- No significant difference between the classification accuracy of CHAID and QUEST
- How to validate our classification result?
- Use dataset from Kipper 1 for evaluation, which is close to Kipper 2
- Problems
  - In Kipper 1 dataset, P_SONIC is not available
  - Delete P_SONIC in Kipper 2 dataset
  - Rebuild CHAID and QUEST, respectively

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Experimental Results

- Data transformation for Kipper 1 dataset
  - RHOB, DRHO, GAMMA, NPHI, LLD, LLS, MSFL
  - 18434 samples from Kipper 1
  - Remove invalid values, e.g. -999.25; negative value in DRHO
  - 7545 samples remained

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Experimental Results

			0	1	
Training	Count	0	3302	881	4183
		1	491	2648	3139
	Percent	0	79	21	100
		1	16	84	100

			0	1	
Testing	Count	0	3379	1411	4790
		1	754	2001	2755
	Percent	0	71	29	100
		1	27	73	100

			0	1	
Training	Count	0	3882	301	4183
		1	680	2459	3139
	Percent	0	93	7	100
		1	22	78	100

			0	1	
Testing	Count	0	4201	589	4790
		1	1059	1696	2755
	Percent	0	88	12	100
		1	38	62	100

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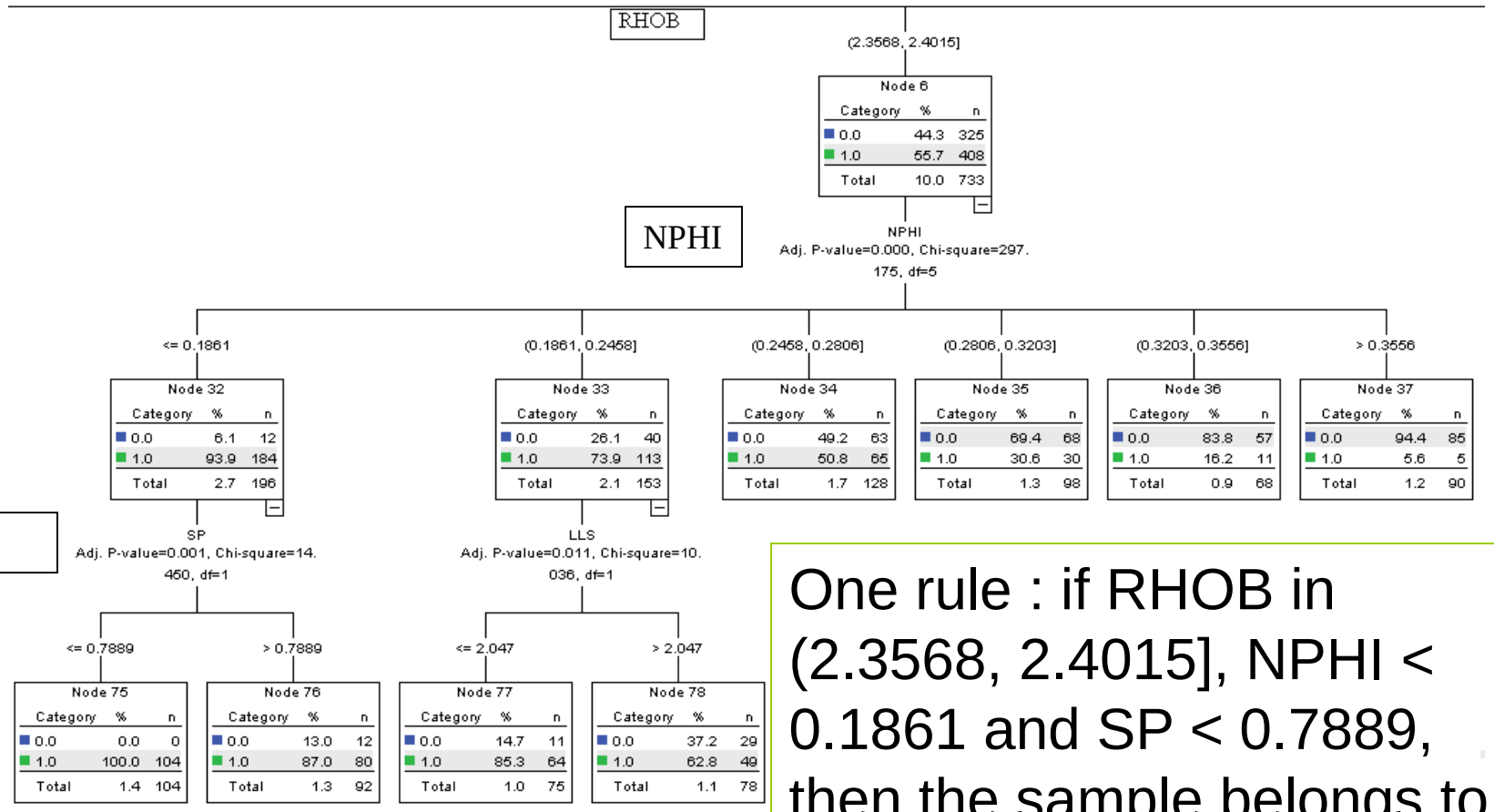
CHAID



One rule : if RHOB in (2.3568, 2.4015], NPHI < 0.1861 and SP < 0.7889, then the sample belongs to reservoir level

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Conclusion

- It is feasible to use the patterns or model obtained from Kipper 2 well to Kipper 1 well for reservoir and non-reservoir prediction
- Adjust the training samples to improve the prediction accuracy

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