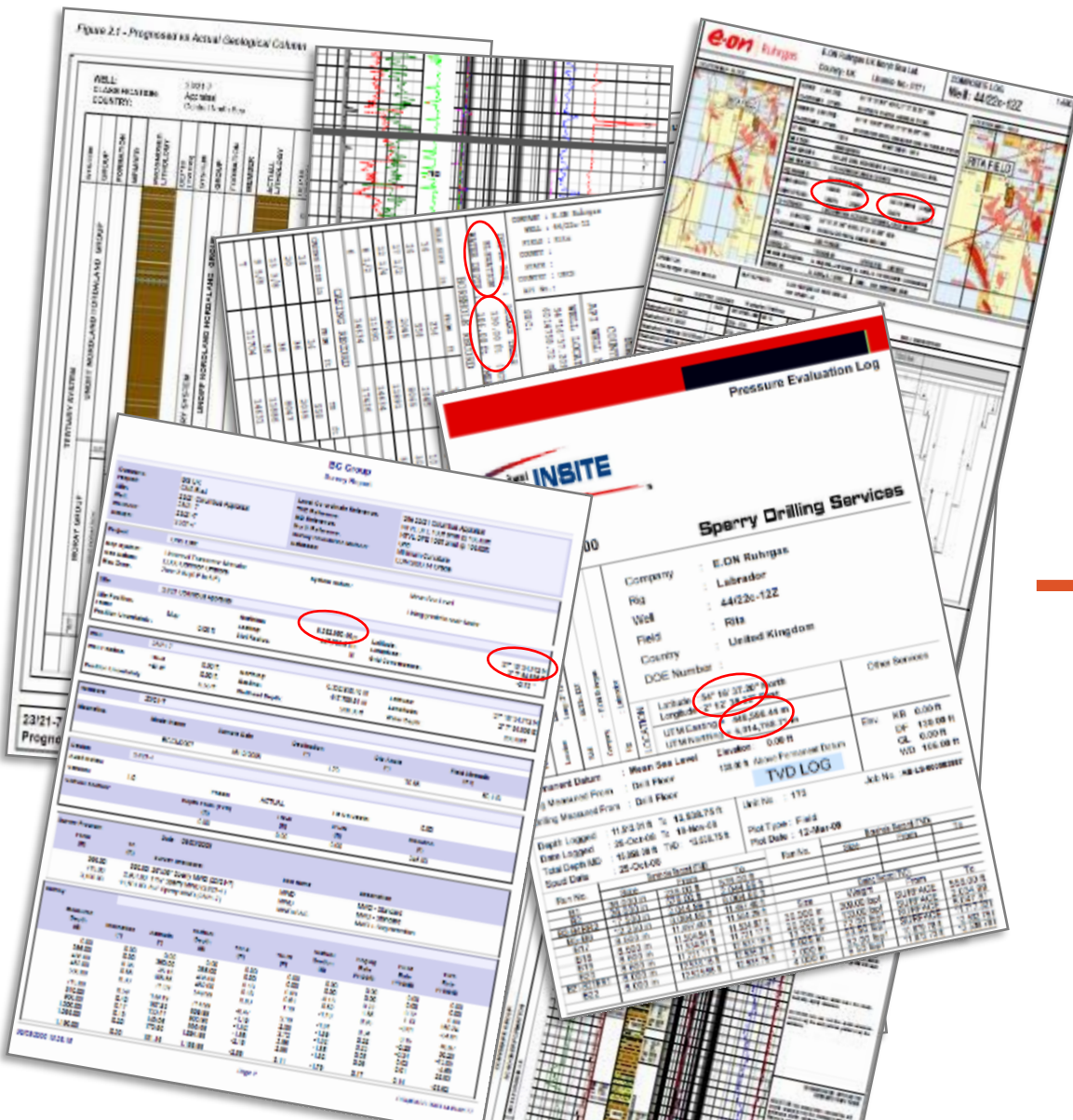


What ever is your business,
structured information delivers
reliable decisions

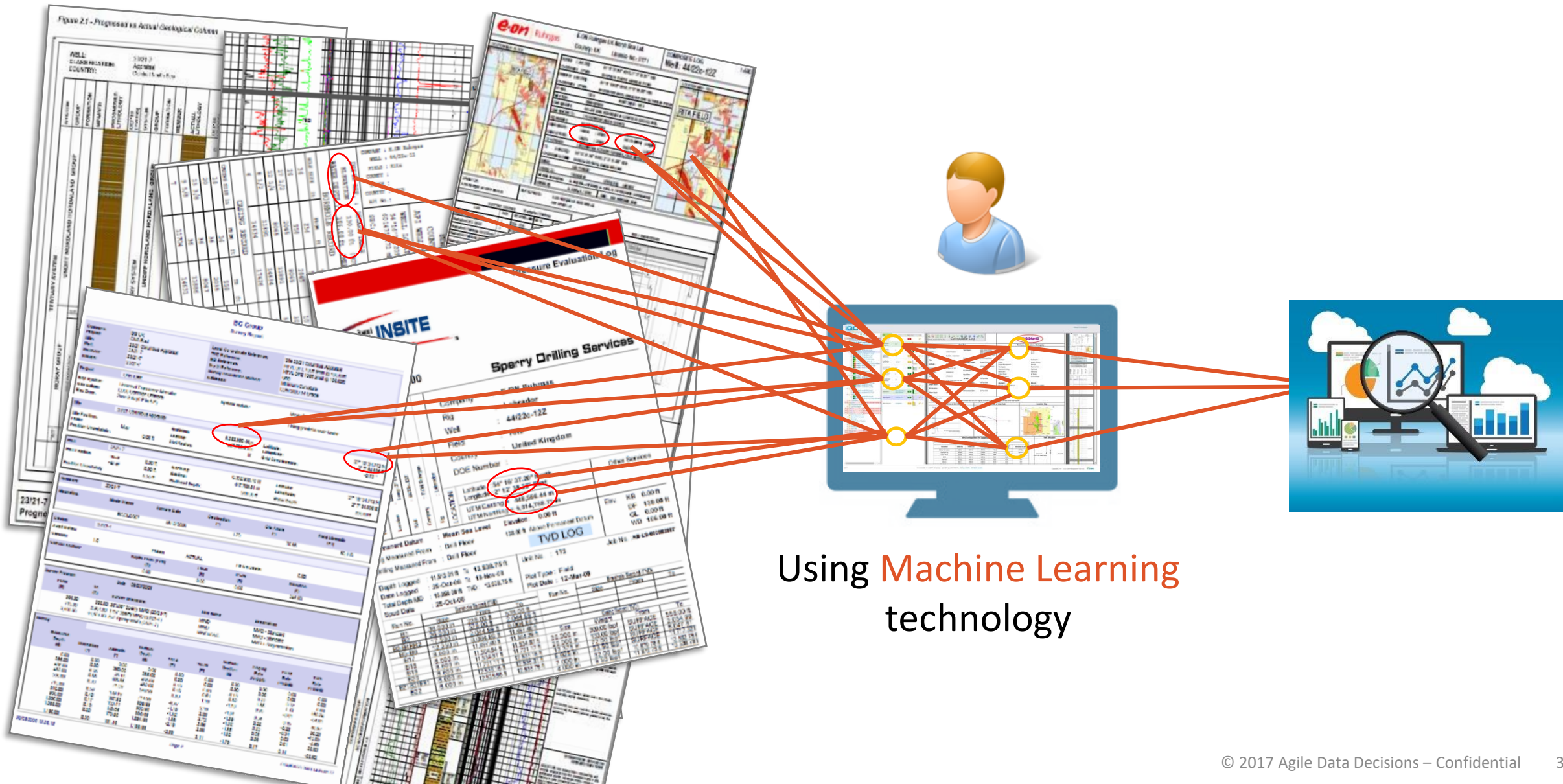
How to produce **trustable**
information with a ML ?

www.agileDD.com
EAGE ML workshop
November 30rd 2018

Extracting information from unstructured documents is expensive and time consuming



We automate the indexing process



Using Machine Learning
technology

The advantages of **automated** indexing

**SAVE
MONEY**

Avoid populating
databases manually

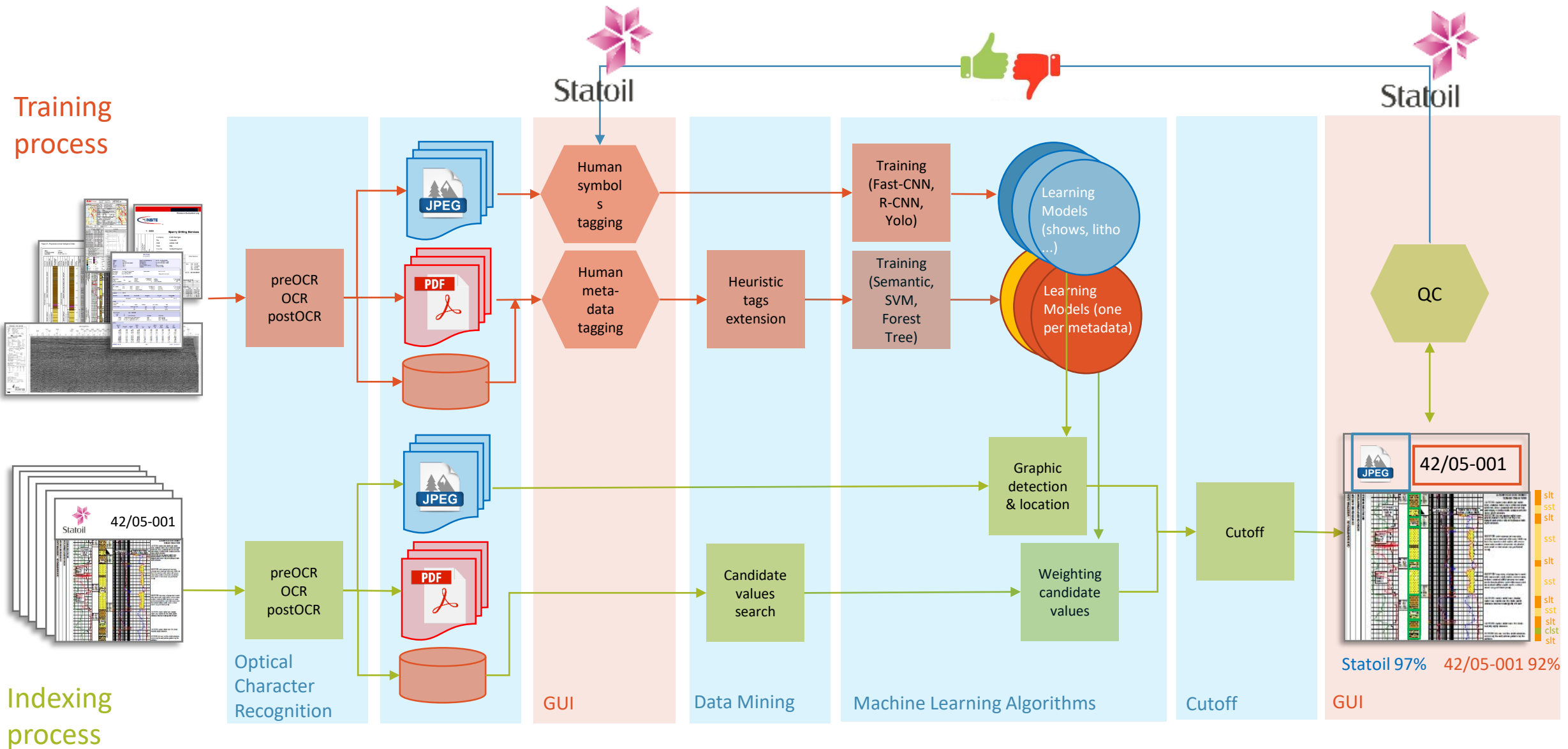
GO FASTER

From data to decision

**DE-
RISK**

Using more verified
information

iQC workflow



End of presentation

End of presentation ?

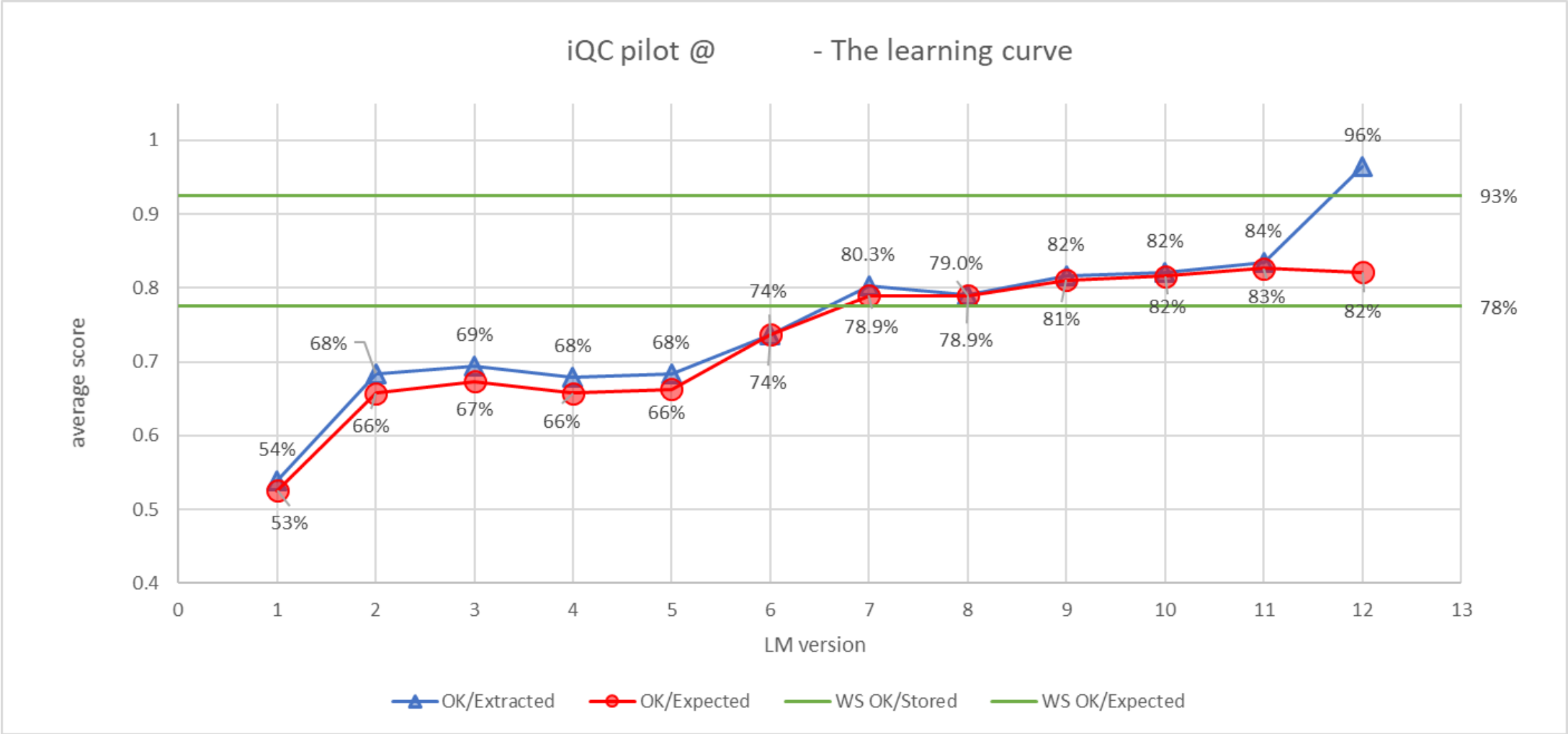
- But **data users don't care** how the information has been extracted, by a machine or by humans,
- **Data users even don't care** so much if all the data are accessible and made available,
- Data users want data they **TRUST !**

Select your **training data** with care ... but **not too much**



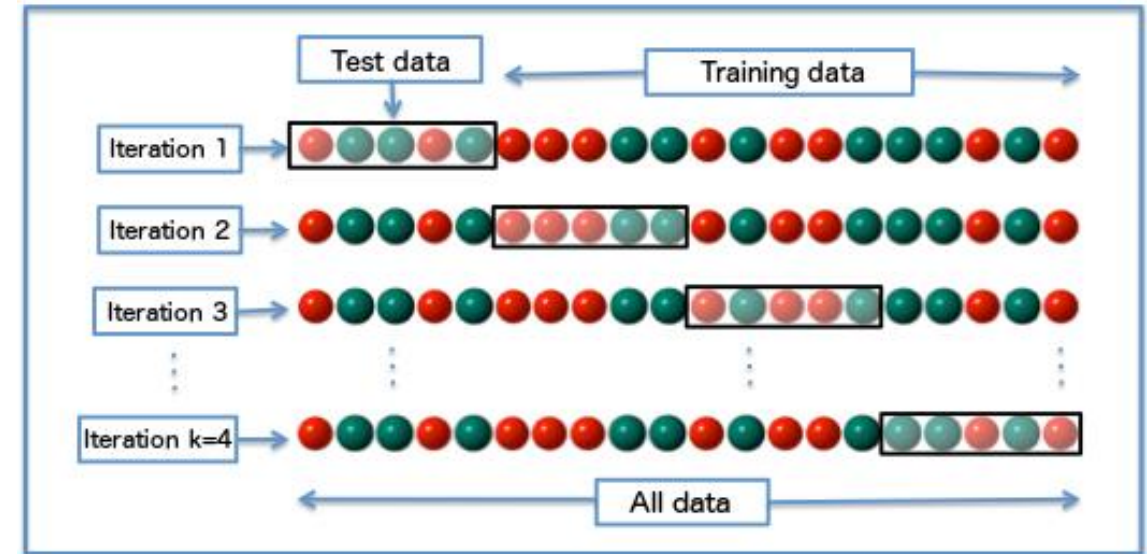
- Machine learning are **better to interpolate** than **extrapolate**,
- Training set must be **representative** of the data set to be processed,
- **....easiest to say than to do!** Since you don't know the content of the data set to be processed,
- You can approach the representativeness of the training set by indirect features
 - Files format, Files size, Graphic files resolution, Files name, Files language, Files vintage ...
- **Don't worry to much**
- Few contexts may be relevant to train a characteristic of the data
- Training set may be **extended** while going, ML improve with experience

Monitor your training process



Explain your benchmark methods

- More or less exhaustive cross validation
 - Leave p out method (Lpo)
 - Leave one out (Jack Knife method)
 - Hold out method
 - Benchmark
 - Blind test



Define clearly the KPIs

Navigation

Normal

2/4-k (1) Extracted Info Item needs a unit
2/4-k-2 (3) Extracted Info Item needs a unit
2/4-k-2-t-4 (15) Extracted Info Item needs a unit
2/4-k-23 (3) Extracted Info Item needs a unit
2/4-k-29-a (8) Extracted Info Item needs a unit
2/4-k-4 (14) Extracted Info Item needs a unit

Extracted Information
PRODUCTION (8)
CCL (2)
0002_04_K_04_1910594_gr_temp_press.PDF
0002_04_K_04_1910594_temp_lapse.PDF
INTEGRITY (4)
2/4-k-4-a (32) Extracted Info Item needs a unit
Extracted Information
PERFORATION (8)
PRODUCTION (1)
INTEGRITY (11)
0002_04_K_04_A_03Jun2014_K04_MIT_provisional.p
0002_04_K_04_A_COP_EKOK_BS6.5in_FMI-GR-40-
0002_04_K_04_A_MIT_PSP_046PUC.las
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04-
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04-
0002_04_K_04_A_PSP_047PUC.las
0002_04_K_04_A_PSP_049PUC.las
0002_04_K_04_A_ConocoPhillips_Eko-K-4_A_17June
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4-K-04-
0002_04_K_04_A_PMIT_18Jun2014_Summary_Rep
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04-
PRESSURE TEMPERATURE (3)
0002_04_K_04_A_PressTemp_Log_31-May-2014_Fin
0002_04_K_04_A_PressTemp_Log_Up_014LUC.las
0002_04_K_04_A_PressTemp_Log_Down_032PUC.las
CEMENT BOND LOG (9)
0002_04_K_04_A_RUN1B_FMI_MAIN-PASS_NO-EM
0002_04_K_04_A_RUN1B_CBL-MAIN_Customer.las
0002_04_K_04_A_COP_EKOK_BS6.5in_MSIP-GR-20
0002_04_K_04_A_RUN1B_CBL-REPEAT_Customer.l
0002_04_K_04_A_RUN1B_MSIP_MAIN-PASS_NO-E
0002_04_K_04_A_COP_EKOK_BS6.5in_PPC-GR-20
0002_04_K_04_A_RUN1B_PPC_MAIN-PASS_NO-EM
0002_04_K_04_A_COP_EKOK_7.75in_CBL-GR-40_C

Extracted Info

Document	Category	CCL	99
Well Name	2/4-k-04	88	
Logging reference elevation		0	
Logging date	13-apr-2006	42	
Total Depth Driller	13015	67	
Total Depth Logger	100	19	
Start log interval		0	
Stop log interval		0	
Bottom log interval		0	
Top log interval	100	39	
Logging service name	temperature	93	
Logging service company	raker atlas	100	
Logging unit number		0	
Logging tools	temp	69	
Well site geologist		0	

Curves

Lithology

0002_04_K_04_1910594_gr_temp_press.PDF

True Positive

False Positive

Missing data

PERMANENT DATUM
LOG MEASURED FROM
DRILL MEAS. FROM

MSL
ELEVATION
0 FT
ABOVE P.D.

FILE NO:
API NO:
1:200
Ver. 3.87
FIELD PRINT

COMPANY
WELL
FIELD
RIG NAME
2/4-K-04
EKOFISK
2/4-K
COUNTRY
NORWAY

LOCATION:
LAT: 59 DEG 33 MIN 55.787 SEC N
LONG: 12 DEG 12 MIN 22.155 SEC E

OTHER SERVICES
NONE

GAMMA RAY LOG
TEMPERATURE LOG
PRESSURE
CASING COLLAR LOCATION

BAKER
HUGHES

BAKER
Atlas

Navigation

1

2

3

4

Define clearly the **KPIs**

- **Precision** = True Positive / (True Positive + False Positive)
- **Recall** = True Positive / (True Positive + Missing)
- **F1 score** = $2 * (\text{Precision} * \text{Recall}) / (\text{Precision} + \text{Recall})$
- Not only you start feeling like a data scientist now, but you can produce a learning curve !
- Possibility to anticipate what will be the accuracy of the detection before the first detection.




 The image shows the Excel ribbon with the Home tab selected. The ribbon is divided into several groups: Clipboard (Paste, Copy, Format Painter), Font (Font face, Size, Bold, Italic, Underline, Text color, Background color), Alignment (Align Left, Center, Right, Justify, Wrap Text, Merge & Center), Number (General, Text, Comma, Percentage, Decimal, Fraction, Scientific), Styles (Normal, Check Cell, Explanatory..., Input, Linked Cell, Note), Cells (Insert, Delete, Format), and Editing (AutoSum, Fill, Clear, Sort & Filter, Find & Select). The ribbon is displayed in a light blue theme.

Picture 1																				
X																				
fx																				
	A	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1	filename	ing date (DATE, DLA	Ref Ele	TDD	TDL	Start dept	Stop depth	Top	Bot	Log interval	Service name 1 (H	SN 2	SN 3	Logging to	LT2	LT3	LT4	LT5	Logging co	Loggin
17	0002_04_K_02_T4_PLT_INJECTION_STATIONARY_14295FT.las	mar 28 17-08-19 2017	no data	no data	no data	1.00	475.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Halliburton Lo	no data
18	0002_04_K_02_T4_SHUT-IN_A-ANNULUS_OPEN_30FTMIN_UP_3979-12099FT.las	mar 27 12-29-37 2017	no data	no data	no data	12100.00	3980.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Halliburton Lo	no data
19	0002_04_K_02_T4_SHUT-N_30FTMIN_DOWN_3671-14392FT.las	mar 27 00-42-40 2017	no data	no data	no data	3671.25	14392.25	no data	no data	no data	no data			no data	no data	no data	no data	no data	Halliburton Lo	no data
20	0002_04_K_04_A_PMIT_18Jun2014_Summary_Report.pdf	no data	no data	no data	no data	no data	no data	no data	no data	11 700ft – 11 200	no data			PMIT-B	no data	no data	no data	no data	no data	no data
21	0002_04_K_04_A_03Jun2014_K04_MIT_provisional.pdf	03-Jun-14	no data	no data	no data	no data	no data	no data	no data	no data	Multifinger caliper analysis			prt	caliper	ccl	mit	temp	Archer	no data
22	0002_04_K_04_A_03Jun2014_MIT_rapid_1.pdf	03-Jun-14	no data	no data	no data	no data	no data	no data	no data	no data	Multifinger caliper			no data	no data	no data	no data	no data	Archer	no data
23	0002_04_K_04_A_CBL_GR_40_07Apr14.Pdf	07-Apr-14	181.00	13644.00	13644.00	no data	no data	5820.00	13650.00	no data	Cement Bond Log			FMI	MSIP	PPC	GR	no data	Schlumberger	
24	0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_A_PMIT_18Jun2014_Extended_Summary_Report.pdf	03-Jun-14	no data	no data	no data	no data	no data	no data	no data	11 700ft – 11 200	no data			PMIT-B	PMIT-A	PMIT	no data	no data	Schlumberger	no data
25	0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_A_PMIT_18Jun2014_Summary_Report - Copy.pdf	03-Jun-14	no data	no data	no data	no data	no data	no data	no data	12 700ft – 11 200	no data			PMIT-B	PMIT	no data	no data	no data	no data	no data
26	0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_A_PMIT_18Jun2014_Summary_Report.pdf	03-Jun-14	no data	no data	no data	no data	no data	no data	no data	13 700ft – 11 200	no data			PMIT-B	PMIT	no data	no data	no data	no data	no data
27	0002_04_K_04_A_ConocoPhillips_Eko-K-4_A_17June14_Combined_MultifingerCaliper.PDF	18-Jun-14	180.75	13644.00	11750.00	no data	no data	11100.00	11730.00	no data	MULTIFINGER CALIPER LOG			PMIT-B	GR	CCL	ERS	no data	Schlumberger	
28	0002_04_K_04_A_ConocoPhillips_K-4_SafeJet_June-2014.PDF	25-Jun-14	180.75	13645.00	13342.00	no data	no data	12300.00	13300.00	no data	Perforation Depth Record			Safejet Guns	cal-b	as-ers	as_shm	no data	Schlumberger	
29	0002_04_K_04_A_COP_EKOK_7.75in_CBL-GR-40_07Apr14.Pdf	07-Apr-14	181.00	13644.00	13644.00	no data	no data	5820.00	13650.00	no data	Cement Bond Log			FMI	MSIP	PPC	GR	no data	Schlumberger	
30	0002_04_K_04_A_COP_EKOK_Bs6.5in_FMI-GR-40_07Apr14.Pdf	07-Apr-14	181.00	13644.00	13644.00	no data	no data	5820.00	13650.00	no data	Fullbore Formation Microimager			FMI	MSIP	PPC	GR	EDTC	Schlumberger	
31	0002_04_K_04_A_COP_EKOK_Bs6.5in_MSIP-GR-200_07Apr14.Pdf	07-Apr-14	181.00	13644.00	13644.00	no data	no data	5820.00	13650.00	no data	Modular Sonic Imaging Platform			FMI	MSIP	PPC	GR	EDTC	Schlumberger	
32	0002_04_K_04_A_COP_EKOK_Bs6.5in_PPC-GR-200_07Apr14.Pdf	07-Apr-14	181.00	13644.00	13644.00	no data	no data	5820.00	13650.00	no data	Powered Positioning Caliper			FMI	EMA	MSIP	PPC	GR	Schlumberger	
33	0002_04_K_04_A_MIT_PSP_046PUC.las	18-Jun-14	180.75	13644	11750.00	11745.50	11367.50	11100.00	11730.00	no data	MULTIFINGER CALIPER LOG			PMIT-B	GR	CCL	no data	no data	Schlumberger	
34	0002_04_K_04_A_PressTemp_Log_31-May-2014_Final.PDF	31-May-14	181.00	13645.00	13342.00	no data	no data	4775.00	13300.00	no data	Perforation Correlation Log			GR	TEMP	Pressure	CCL	ERS	Schlumberger	
35	0002_04_K_04_A_PressTemp_Log_Down_032PUC.las	31-May-14	181.00	no data	no data	13317.50	4766.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	no data
36	0002_04_K_04_A_PressTemp_Log_Up_014LUC.las	31-May-14	no data	no data	no data	13353.00	32.50	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	no data
37	0002_04_K_04_A_PSP_047PUC.las	18-Jun-14	180.75	13644.00	11750.00	11737.50	10965.50	11100.00	11730.00	no data	MULTIFINGER CALIPER LOG			PMIT-B	GR	CCL	no data	no data	Schlumberger	
38	0002_04_K_04_A_PSP_049PUC.las	18-Jun-14	180.75	13644.00	11750.00	5900.00	5699.50	11100.00	11730.00	no data	MULTIFINGER CALIPER LOG			PMIT-B	GR	CCL	no data	no data	Schlumberger	
39	0002_04_K_04_A_Run1_Correlation_Pass_024LUC.las	25-Jun-14	180.75	13645.01	13342.00	13311.50	12714.00	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
40	0002_04_K_04_A_Run1_Guns1-23_Positioning_027LUC.las	25-Jun-14	180.75	13645.01	13342.00	13312.50	12771.00	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
41	0002_04_K_04_A_Run1_Guns24-26_Positioning_030LUC.las	25-Jun-14	180.75	13645.01	13342.00	13100.00	12783.00	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
42	0002_04_K_04_A_RUN1B_CBL-MAIN_Customer.las	04-12-14	181.00	no data	no data	5670.00	12543.50	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	
43	0002_04_K_04_A_RUN1B_CBL-REPEAT_Customer.las	04-12-14	181.00	no data	no data	5658.00	6520.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	
44	0002_04_K_04_A_RUN1B_FMI-MAIN-PASS_NO-EMM_Customer.las	04-11-14	181.00	no data	no data	12125.50	13693.50	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	
45	0002_04_K_04_A_RUN1B_FMI-PASS_NO-EMM_Customer.las	04-11-14	181.00	no data	no data	12132.00	13702.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	
46	0002_04_K_04_A_RUN1B_MSIP-MAIN-PASS_NO-EMM_Customer.las	04-11-14	181.00	no data	no data	12125.50	13693.50	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	
47	0002_04_K_04_A_RUN1B_PPC-MAIN-PASS_NO-EMM_Customer.las	04-11-14	181.00	no data	no data	12125.50	13693.50	no data	no data	no data	no data			no data	no data	no data	no data	no data	Schlumberger	
48	0002_04_K_04_A_Run2_Correlation_Pass_040LUC.las	25-Jun-14	180.75	13645.01	13342.00	13300.00	12652.50	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
49	0002_04_K_04_A_Run2_Guns1-13_Positioning_043LUC.las	25-Jun-14	180.75	13645.01	13342.00	13194.50	12480.00	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
50	0002_04_K_04_A_Run3_Correlation_Pass_052LUC.las	25-Jun-14	180.75	13645.01	13342.00	13300.00	12163.50	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
51	0002_04_K_04_A_Run3_Guns1-20_Positioning_053LUC.las	25-Jun-14	180.75	13645.01	13342.00	13300.00	12297.50	no data	no data	no data	Perforation Depth Re 3 1/8 Safejet Guns			no data	no data	no data	no data	no data	Schlumberger	
52	0002_04_K_23_1174677_sbt.dls																			
53	0002_04_K_23_1174677_sbt.PDF	26-07-06	181.00	11113.00	no data	no data	no data	20.00	4584.00	no data	SEGMENTED BOND TOOL			SBT	VDL	PLUG	no data	no data	Baker Atlas	3861SL
54	0002_04_K_23_1174677_sbt_main.las	26-07-06	no data	no data	no data	1.75	4606.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Baker Atlas	no data
55	0002_04_K_23_1174677_sbt_repeat.las	26-07-06	no data	no data	no data	4334.75	4610.00	no data	no data	no data	no data			no data	no data	no data	no data	no data	Baker Atlas	no data
56	0002_04_K_24_USIT_CBL_13.375in-MAIN.dlis	26 August 2015	56.998	1661.20	1661.20	no data	no data	107.90	1442.60	no data	no data			no data	no data	no data	no data	no data	no data	LS 048
57	0002_04_K_24_USIT_CBL_13.375in-REPEAT.dlis	26 August 2015	56.998	1661.20	1661.20	no data	no data	107.90	1442.60	no data	no data			no data	no data	no data	no data	no data	no data	LS 048
58	0002_04_K_29_A_2595486_Corr_P1_I1.las	21-05-09	181.00	13950.00	no data	13211.00	13433.00	13210.00	13679.00	no data	WIRELINE PERFORATIC 2.5" selective fire			no data	no data	no data	no data	no data	Baker Atlas	104
59	0002_04_K_29_A_2595486_Corr_P1_I2.las	21-05-09	181.00	13950.00	no data	13101.00	13604.50	13210.00	13679.00	no data	WIRELINE PERFORATIC 2.5" selective fire			no data	no data	no data	no data	no data	Baker Atlas	104
60	0002_04_K_29_A_2595486_Corr_P2_I1.las	25-05-09	181.00	13950.00	no data	12683.25	13372.50	12685.00	13370.00	no data	WIRELINE PERFORATIC 2.5" selective fire			no data	no data	no data	no data	no data	Baker Atlas	104
61	0002_04_K_29_A_2595486_Corr_P2_I2.las	25-05-09	181.00	13950.00	no data	12642.75	13453.50	12685.00	13370.00	no data	WIRELINE PERFORATIC 2.5" selective fire			no data	no data	no data	no data	no data	Baker Atlas	104
62	0002_04_K_29_A_2595486_gr_ccl.las	20-05-09	181.00	13950.00	13754.00	11800.00	13755.00	100.00	13754.00	no data	CASING COLLAR LOCAT TEMPERATU GAMMA RAY			no data	no data	no data	no data	no data	Baker Atlas	104
63	0002_04_K_29_A_2595486_gr_ccl_main_log.las	20-05-09	181.00	13942.00	13754.00	11800.00	13755.00	100.00	13754.00	no data	CASING COLLAR LOCAT TEMPERATU GAMMA RAY			no data	no data	no data	no data	no data	Baker ATLAS	104

Agile Data Decisions

File Home Insert Page Layout Formulas Data Review View Add-ins Help Power Pivot XY Chart Labels Tell me what you want to do

Clipboard Font Alignment Number Styles Cells Editing

Normal Bad Good Neutral Calculation Check Cell Explanatory ... Input Linked Cell Note

Comment

	A	B	AT	AU	AV	AX	AY	AZ	BA	BC	BD	BE	BF	BH	BI	BJ	BK
1	filename	Logging date	BenchMark9				BenchMark10				BenchMark11				BenchMark12		
2	0002_04_K_02_ACX_REPORT_REV-A.pdf	March 30th 2017	26		-1	11-03-03	20		-1	04-01-16	20		-1	11-03-03	18		-1
3	0002_04_K_02_T4_PLT_INJECTION_30FTMIN_UP_4036-11839FT.las	mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1	tue mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1	tue mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1	tue mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1
4	0002_04_K_02_T4_2017_03_27_0130_PLT_SHUT-N_30FTMIN_DOWN_3671	mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1	mon mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1	mon mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1	mon mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1
5	0002_04_K_02_T4_2017_03_27_1330_PLT_SHUT-IN_A-ANNULUS OPEN_30	mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1	mon mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1	mon mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1	mon mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1
6	0002_04_K_02_T4_2017_03_28_1708_CoP_K-2_PLT_INJECTION_STATIONA	mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1	tue mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1	tue mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1	tue mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1
7	0002_04_K_02_T4_2017_03_28_1845_CoP_K-2_PLT_INJECTION_30FTMIN	mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1	tue mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1	tue mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1	tue mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1
8	0002_04_K_02_T4_2017_03_28_2145_CoP_K-2_PLT_INJECTION_STATIONA	mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1	tue mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1	tue mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1	tue mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1
9	0002_04_K_02_T4_2017_03_28_2245_CoP_K-2_PLT_INJECTION_STATIONA	mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1	tue mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1	tue mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1	tue mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1
10	0002_04_K_02_T4_2017_03_28_2250_CoP_K-2_PLT_INJECTION_30FTMIN	mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1	tue mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1	tue mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1	tue mar 28 22-08-45 2017	90	tue mar 28 22-08-45 2017	1
11	0002_04_K_02_ACX_REPORT_REV-A.pdf	March 30 2017	26		-1	11-03-03	20		-1	04-01-16	20		-1	11-03-03	18		-1
12	0002_04_K_02_T4_March2017_OverburdenTempLogging.xlsm	March 24 2015 to March 29 2017			-1				-1				-1				-1
13	0002_04_K_02_T4_OverburdenLoggingMarch2017.pptx	March 24 2015 to March 29 2017			-1				-1				-1				-1
14	0002_04_K_02_T4_PLT_INJECTION_30FTMIN_UP_12000-14327FT.las	mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1	tue mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1	tue mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1	tue mar 28 18-26-46 2017	90	tue mar 28 18-26-46 2017	1
15	0002_04_K_02_T4_PLT_INJECTION_STATIONARY_10515FT.las	mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1	tue mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1	tue mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1	tue mar 28 22-45-23 2017	90	tue mar 28 22-45-23 2017	1
16	0002_04_K_02_T4_PLT_INJECTION_STATIONARY_11875FT.las	mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1	tue mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1	tue mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1	tue mar 28 21-53-14 2017	90	tue mar 28 21-53-14 2017	1
17	0002_04_K_02_T4_PLT_INJECTION_STATIONARY_14295FT.las	mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1	tue mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1	tue mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1	tue mar 28 17-08-19 2017	90	tue mar 28 17-08-19 2017	1
18	0002_04_K_02_T4_SHUT-IN_A-ANNULUS OPEN_30FTMIN_UP_3979-12099	mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1	mon mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1	mon mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1	mon mar 27 12-29-37 2017	90	mon mar 27 12-29-37 2017	1
19	0002_04_K_02_T4_SHUT-N_30FTMIN_DOWN_3671-14392FT.las	mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1	mon mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1	mon mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1	mon mar 27 00-42-40 2017	90	mon mar 27 00-42-40 2017	1
20	0002_04_K_04_A_PMIT_18Jun2014_Summary_Report.pdf		38		0	18-06-14	33		0	18-06-14	42		0	18-06-14	36		0
21	0002_04_K_04_A_03Jun2014_K04_MIT_provisional.pdf	03-06-14	88	03-06-14	1	03-06-14	88	03-06-14	1	03-06-14	87	03-06-14	1	03-06-14	88	03-06-14	1
22	0002_04_K_04_A_03Jun2014_MIT_rapid_1.pdf	03-06-14	88	03-06-14	1	03-06-14	88	03-06-14	1	03-06-14	88	03-06-14	1	03-06-14	88	03-06-14	1
23	0002_04_K_04_A_CBL_GR_40_07Apr14.Pdf	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1
24	0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_A_PMIT_18Jun2014	03-06-14	49		-1	18-06-14	36		-1	18-06-14	33		-1	18-06-14	51		-1
25	0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_A_PMIT_18Jun2014	03-06-14	38		-1	18-06-14	33		-1	18-06-14	42		-1	18-06-14	36		-1
26	0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_A_PMIT_18Jun2014	03-06-14	38		-1	18-06-14	33		-1	18-06-14	42		-1	18-06-14	36		-1
27	0002_04_K_04_A_ConocoPhillips_Eko-K-4_A_17June14_Combined_Mult	18-06-14	88	17-06-14	-2	17-06-14	88	17-06-14	-2	17-06-14	88	17-06-14	-2	17-06-14	87	17-06-14	-2
28	0002_04_K_04_A_ConocoPhillips_K-4_SafeJet_June-2014.PDF	25-06-14	88	25-06-14	1	25-06-14	88	25-06-14	1				-1	25-06-14	88	25-06-14	1
29	0002_04_K_04_A_COP_EKOK_7.75in_CBL-GR-40_07Apr14.Pdf	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1
30	0002_04_K_04_A_COP_EKOK_B56.5in_FMI-GR-40_07Apr14.Pdf	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1
31	0002_04_K_04_A_COP_EKOK_B56.5in_MSIP-GR-200_07Apr14.Pdf	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1
32	0002_04_K_04_A_COP_EKOK_B56.5in_PPC-GR-200_07Apr14.Pdf	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1	07-04-14	88	07-04-14	1
33	0002_04_K_04_A_MIT_PSP_046PUC.las	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1
34	0002_04_K_04_A_PressTemp_Log_31-May-2014_Final.PDF	31-05-14	88	31-05-14	1	31-05-14	88	31-05-14	1	31-05-14	88	31-05-14	1	31-05-14	88	31-05-14	1
35	0002_04_K_04_A_PressTemp_Log_Down_032PUC.las	31-05-14	90	31-05-14	1	31-05-14	90	31-05-14	1	31-05-14	90	31-05-14	1	31-05-14	90	31-05-14	1
36	0002_04_K_04_A_PressTemp_Log_Up_014LUC.las	31-05-14	90	31-05-14	1	31-05-14	90	31-05-14	1	31-05-14	90	31-05-14	1	31-05-14	90	31-05-14	1
37	0002_04_K_04_A_PSP_047PUC.las	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1
38	0002_04_K_04_A_PSP_049PUC.las	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1	18-06-14	90	18-06-14	1
39	0002_04_K_04_A_Run1_Correlation_Pass_024LUC.las	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1
40	0002_04_K_04_A_Run1_Guns1-23_Positioning_027LUC.las	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1
41	0002_04_K_04_A_Run1_Guns24-26_Positioning_030LUC.las	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1
42	0002_04_K_04_A_RUN1B_CBL-MAIN_Customer.las	04-12-14	90	04-12-14	1	04-12-14	90	04-12-14	1	04-12-14	90	04-12-14	1	04-12-14	90	04-12-14	1
43	0002_04_K_04_A_RUN1B_CBL-REPEAT_Customer.las	04-12-14	90	04-12-14	1	04-12-14	90	04-12-14	1	04-12-14	90	04-12-14	1	04-12-14	90	04-12-14	1
44	0002_04_K_04_A_RUN1B_FMI-MAIN-PASS_NO-EMM_Customer.las	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1
45	0002_04_K_04_A_RUN1B_FMI-PASS_NO-EMM_Customer.las	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1
46	0002_04_K_04_A_RUN1B_MSIP-MAIN-PASS_NO-EMM_Customer.las	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1
47	0002_04_K_04_A_RUN1B_PPC-MAIN-PASS_NO-EMM_Customer.las	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1	04-11-14	90	04-11-14	1
48	0002_04_K_04_A_Run2_Correlation_Pass_040LUC.las	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1	25-06-14	90	25-06-14	1

Rig Name Logging date Reference Elev. TDD TDL STRT STOP BLI TLI Log Interval Service Name Log tools LUN Logging Co Index Acoustic Atten GR Ca ...

Ready

AgileDD

UI: v0.5.6 - Engine: Conversation: id = 765, temporary - Ajax4jfs Log (Ctrl+Shift+D) - [Debug console](#) - [Terminate session](#)
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Precision or Recall ?

Navigation

Normal

2/4-k (1) Extracted Info Item needs a unit
2/4-k-2 (3) Extracted Info Item needs a unit
2/4-k-2+4 (15) Extracted Info Item needs a unit
2/4-k-23 (3) Extracted Info Item needs a unit
2/4-k-29-a (8) Extracted Info Item needs a unit
2/4-k-4 (14) Extracted Info Item needs a unit

Extracted Information
PRODUCTION (8)
CCL (2)
0002_04_K_04_1910594_gr_temp_press.PDF
0002_04_K_04_1910594_temp_lapse.PDF
INTEGRITY (4)
2/4-k-4-a (32) Extracted Info Item needs a unit
Extracted Information
PERFORATION (8)
PRODUCTION (1)
INTEGRITY (11)
0002_04_K_04_A_03Jun2014_K04_MIT_provisional.f
0002_04_K_04_A_COP_EKOK_BS6.5in_FMI-GR-40_...
0002_04_K_04_A_MIT_PSP_046PUC.las
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_...
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_...
0002_04_K_04_A_PSP_047PUC.las
0002_04_K_04_A_PSP_049PUC.las
0002_04_K_04_A_ConocoPhillips_Eko-K-4_A_17June...
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4-K-04_...
0002_04_K_04_A_PMIT_18Jun2014_Summary_Rep...
0002_04_K_04_A_ConocoPhillips_Ekofisk_2_4_K-04_...
PRESSURE TEMPERATURE (3)
0002_04_K_04_A_PressTemp_Log_31-May-2014_Fin...
0002_04_K_04_A_PressTemp_Log_Up_014LUC.las
0002_04_K_04_A_PressTemp_Log_Down_032PUC.la...
CEMENT BOND LOG (9)
0002_04_K_04_A_RUN1B_FMI-MAIN-PASS_NO-EM...
0002_04_K_04_A_RUN1B_CBL-MAIN_Customer.las
0002_04_K_04_A_COP_EKOK_BS6.5in_MSIP-GR-2i...
0002_04_K_04_A_RUN1B_CBL-REPEAT_Customer.l...
0002_04_K_04_A_RUN1B_MSIP-MAIN-PASS_NO-E...
0002_04_K_04_A_COP_EKOK_BS6.5in_PPC-GR-20...
0002_04_K_04_A_RUN1B_PPC-MAIN-PASS_NO-EM...
0002_04_K_04_A_COP_EKOK_7.75in_CBL-GR-40_C...

Document Category CCL 99
Well Name 2/4-k-04 88
Logging reference elevation 0
Logging date 13-apr-2006 42
Total Depth Driller 13015 67
Total Depth Logger 0
Start log interval 0
Stop log interval 0
Bottom log interval 0
Top log interval 100 39
Logging service name temperature 93
Logging service company baker atlas 100
Logging unit number 0
Logging tools temp 69
Well site geologist 0

0002_04_K_04_1910594_gr_temp_press.PDF

True Positive

Missing value

Missing value

Baker Hughes
GAMMA RAY LOG
TEMPERATURE LOG
PRESSURE
CASING COLLAR LOCATION

FILE NO: 2/4-K-04
WELL FIELD: EXOTSK
RIG NAME: 2/4-K
COMPANY: CONOCOPhillips
COUNTRY: NORWAY
OTHER SERVICES: NONE

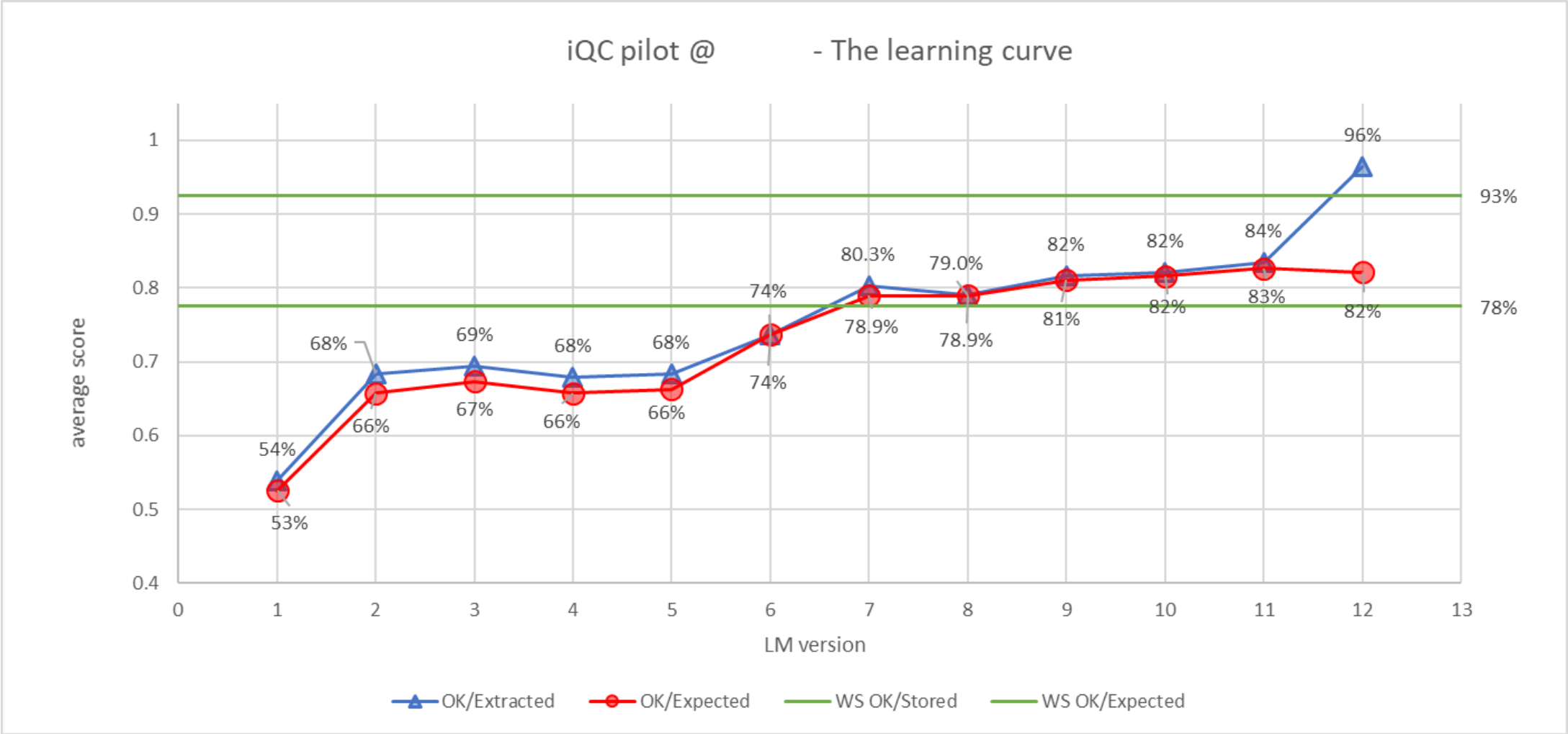
PERMANENT DATUM
LOG MEASURED FROM: 181 FT
ELEVATION: 0 FT
ABOVE P.D.
DRILL MEAS. FROM: 181 FT
ELEVATION: 0 FT
ABOVE P.D.

FIELD PRINT
LAT: 59 DEG 53 MIN 55.767 SEC N
LONG: 12 DEG 12 MIN 22.155 SEC E

ELEVATIONS:
KB 181 FT
DF 181 FT
OL -242 FT

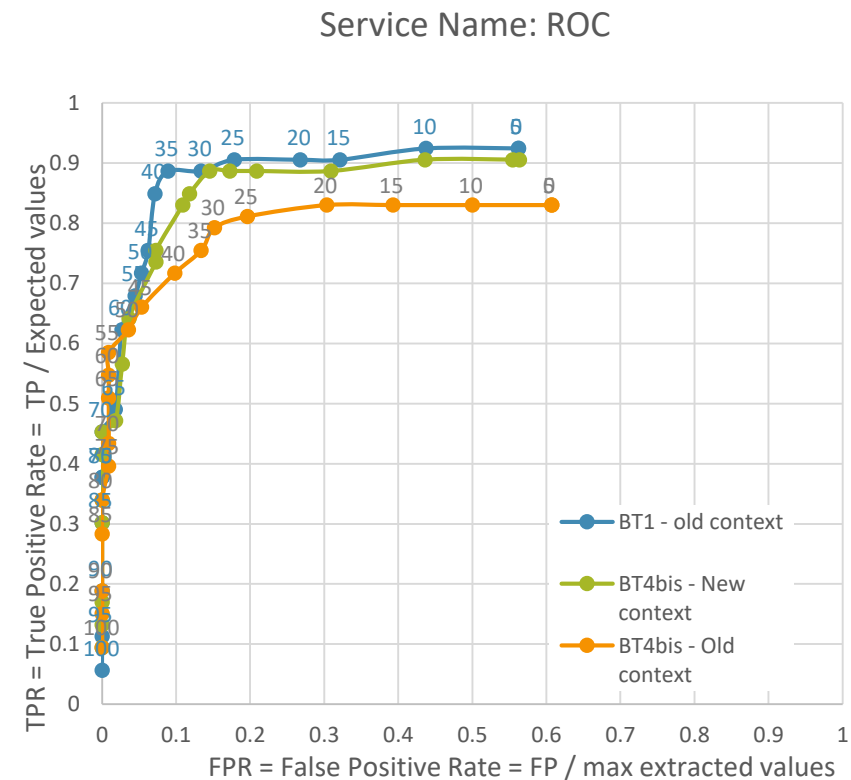
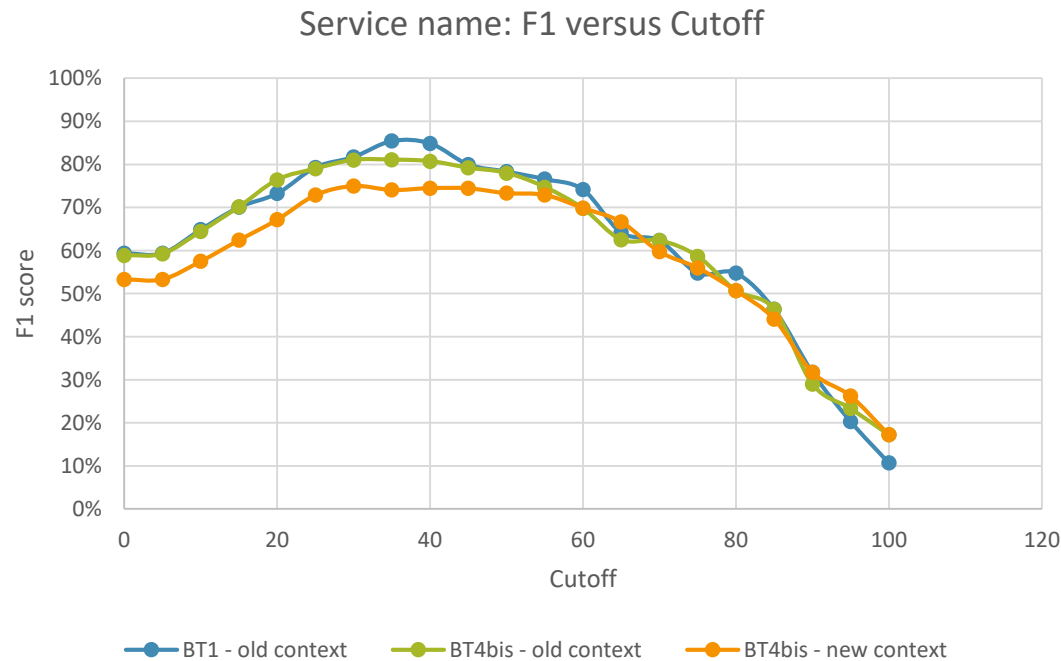
U: v0.5.6 - Engine: Conversation: id = 765, temporary - Ajax4jsf Log (Ctrl+Shift+D) - Debug console - Terminate session Copyright 2016 - Agile Data Decisions, LLC.

Monitor the training process



How to select the best cutoff value?

- A good indexing model is not only a model with a good accuracy (F1)
- It is also a discriminant model



When the False Positives become your best friends



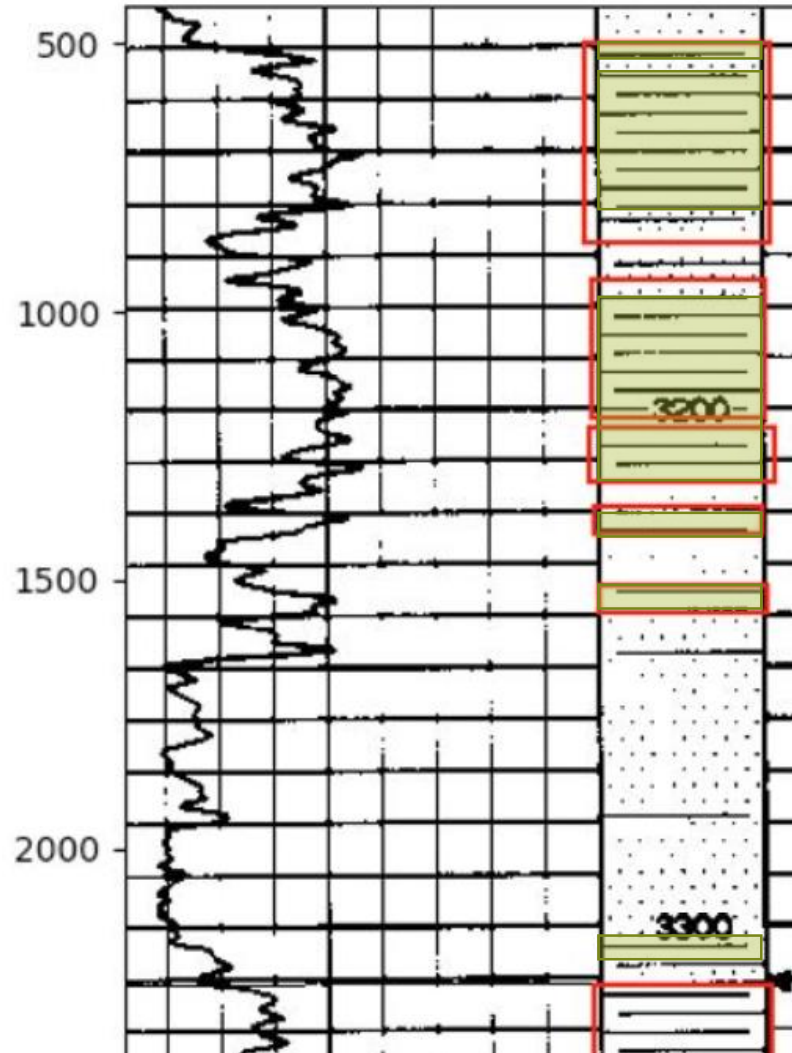
- The beauty of the confusion matrix
 - Confusion matrix adds some transparency onto the ML black boxes!
 - It help reviewing the taxonomy or/and improving the training strategy

		DETECTED							
		INTEGRITY	CEMENT BOND LOG	PERFORATION	PRODUCTION	TEMPERATURE PRESSURE	RESERVOIR SATURATION	CCL	CUTTING
EXPECTED	INTEGRITY	32	0	0	0	0	0	0	0
	CEMENT BOND LOG	0	38	0	0	0	0	0	0
	PERFORATION	0	0	23	0	0	0	0	0
	PRODUCTION	0	0	0	23	0	0	0	0
	TEMPERATURE PRESSURE	0	0	0	0	18	0	0	0
	RESERVOIR SATURATION	0	0	0	0	0	25	0	0
	CCL	0	0	0	0	0	0	12	0
	CUTTING	0	0	0	0	0	0	0	19

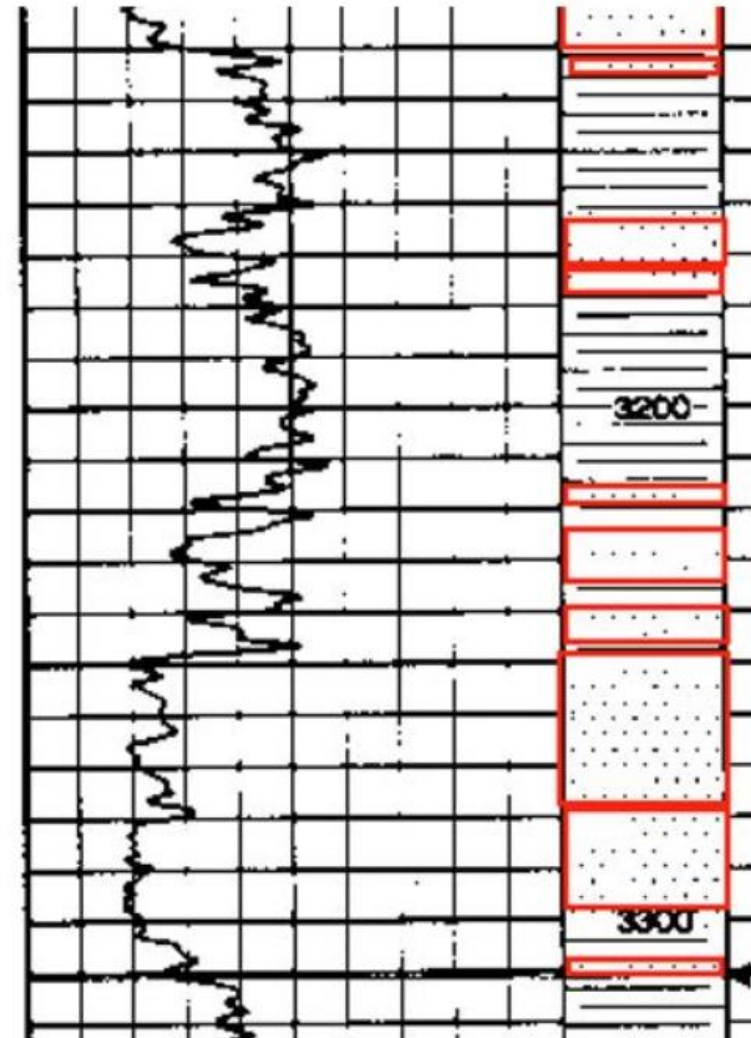
		DETECTED							
		INTEGRITY	CEMENT BOND LOG	PERFORATION	PRODUCTION	TEMPERATURE PRESSURE	RESERVOIR SATURATION	CCL	CUTTING
EXPECTED	INTEGRITY	27	2	0	3	0	0	0	0
	CEMENT BOND LOG	6	30	0	2	0	0	0	0
	PERFORATION	0	0	18	0	0	0	5	0
	PRODUCTION	0	0	0	19	3	0	1	0
	TEMPERATURE PRESSURE	0	0	0	3	15	0	0	0
	RESERVOIR SATURATION	0	0	0	0	0	25	0	0
	CCL	0	0	0	0	0	0	12	0
	CUTTING	0	0	0	0	0	0	4	15

In case of relative truth

Claystone 2 (cly_2)

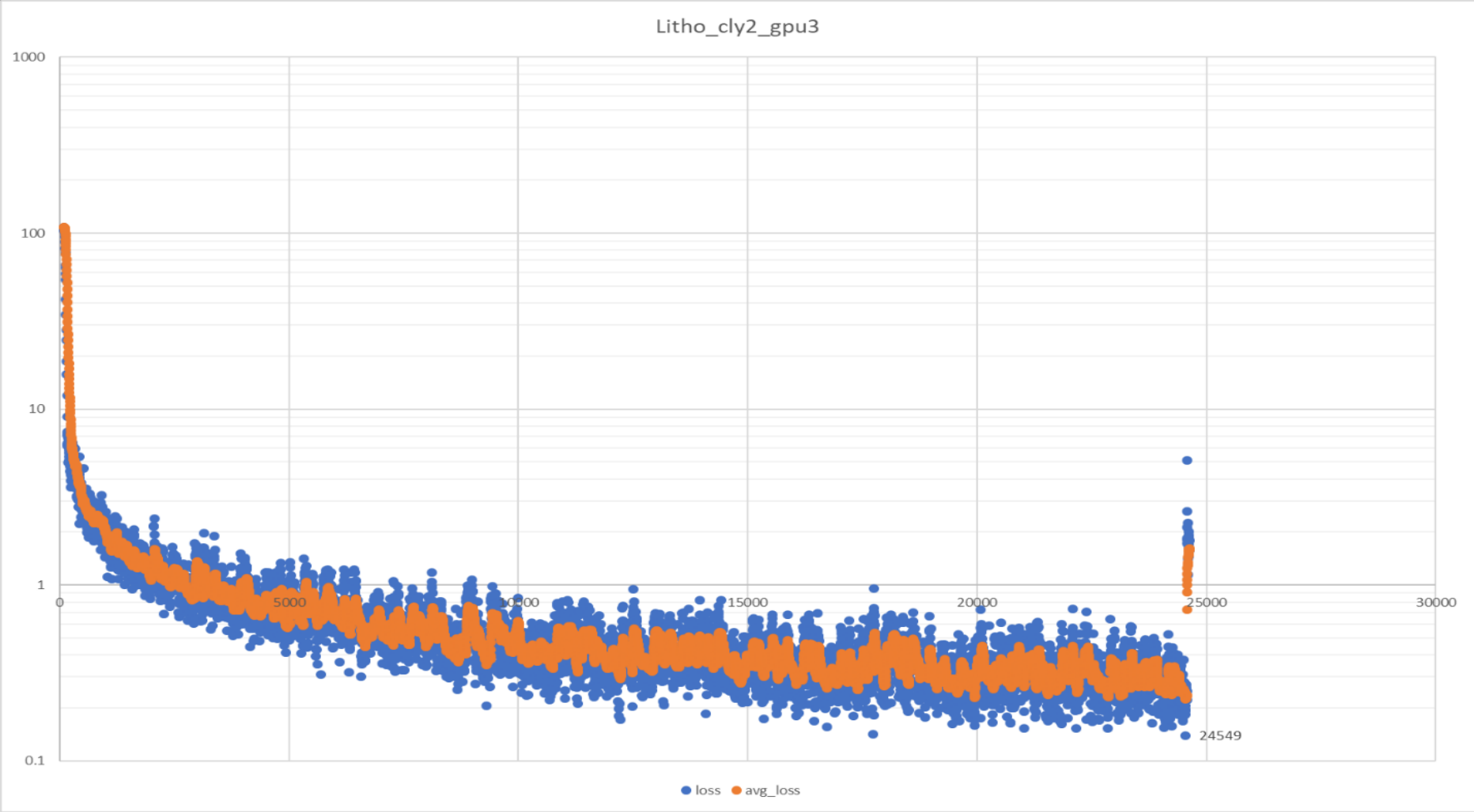


Sandstone (sst_1)



IoU
Intersection
of Unions

Making the training set larger



- Unqualified detections don't make sense for end users,
- It is possible to evaluate various aspects of the **ML models accuracy** before the first detection,
- Detected information **is sourced**
- **All sources** can be used, each metadata may be multi-valuated,
- Possibility to choose between a Recall or Precision strategy using the same ML models
- **Involving the SMEs** while training and tuning the model is key.



Most promising
IT & web startup
2017

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