Hackathon Project Final Presentation

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Longhorn Energy Club

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Executive Summary

The Problem:

Determine the optimum drilling spot for 3 new wells to maximize production over the next two years

Our Approach:

- Analyzed AI data to see reservoir depletion trends
- Performed correlation analysis between features
- Created a model using interpolation and linear regression to predict the optimum new well locations

What did we learn?

- The lower zone generally has higher production
- Some features (…) have a seemingly greater impact on production than others

Our Recommendation

Drilling the 3 new wells in the lower zone at XX, XX, and XX

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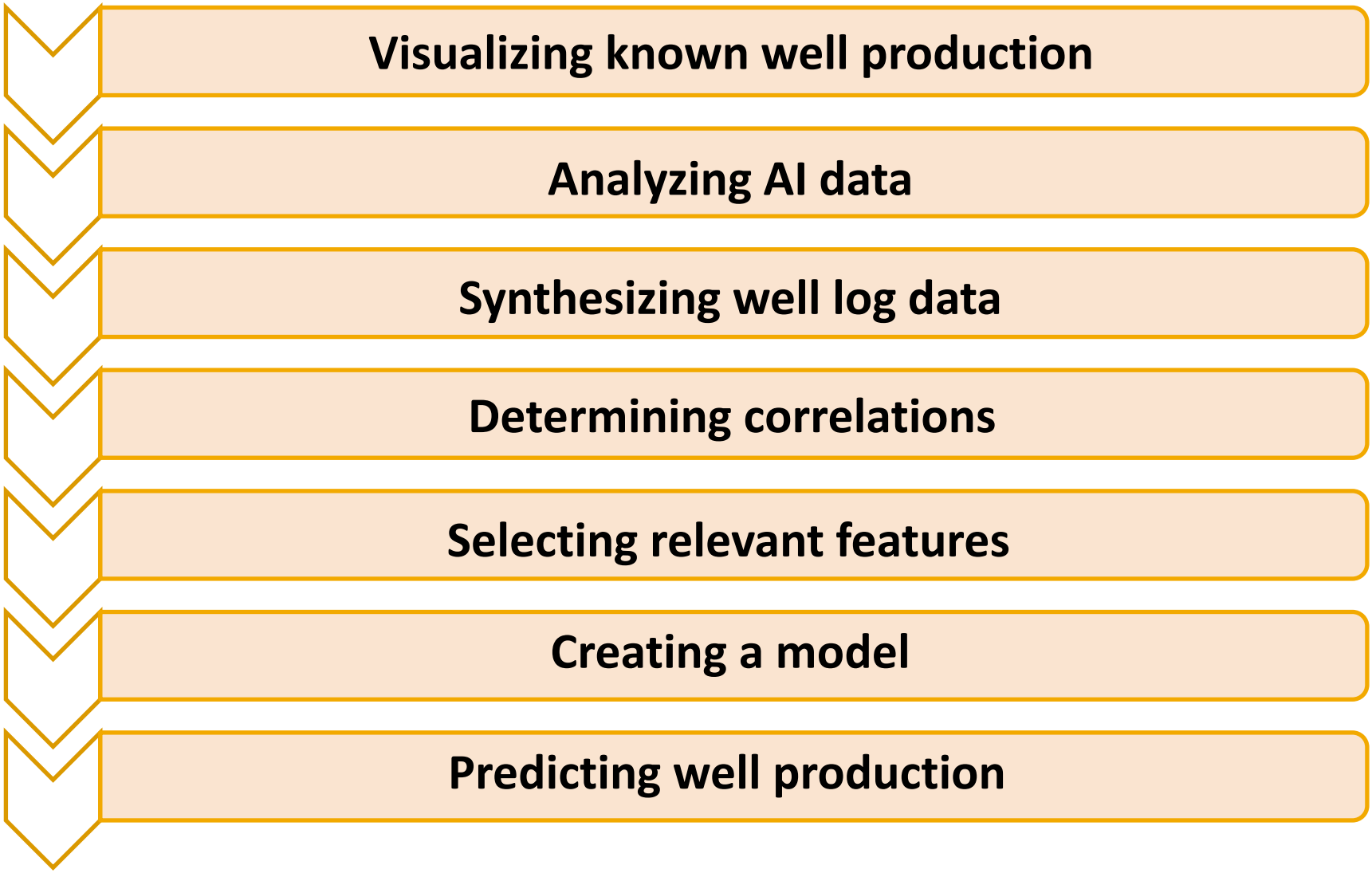
Workflow



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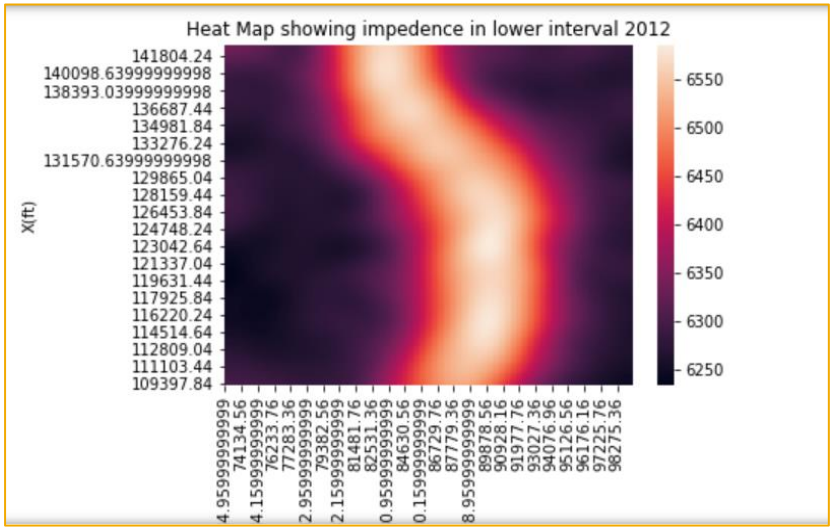
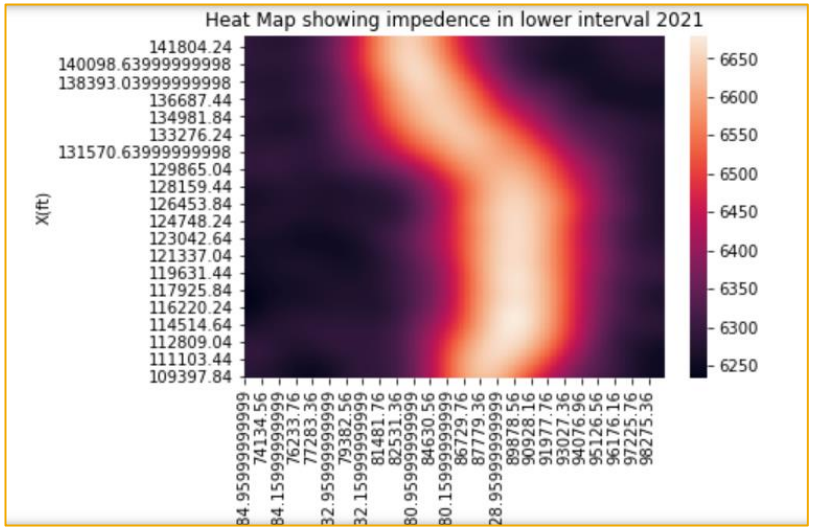
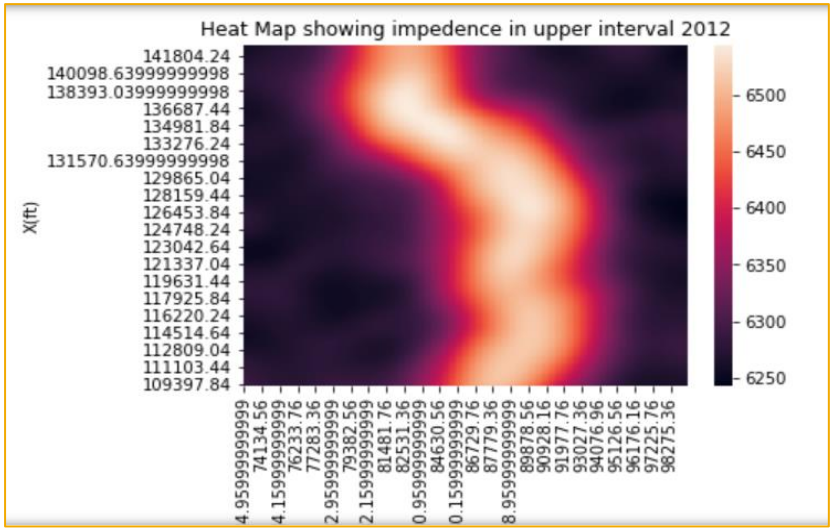
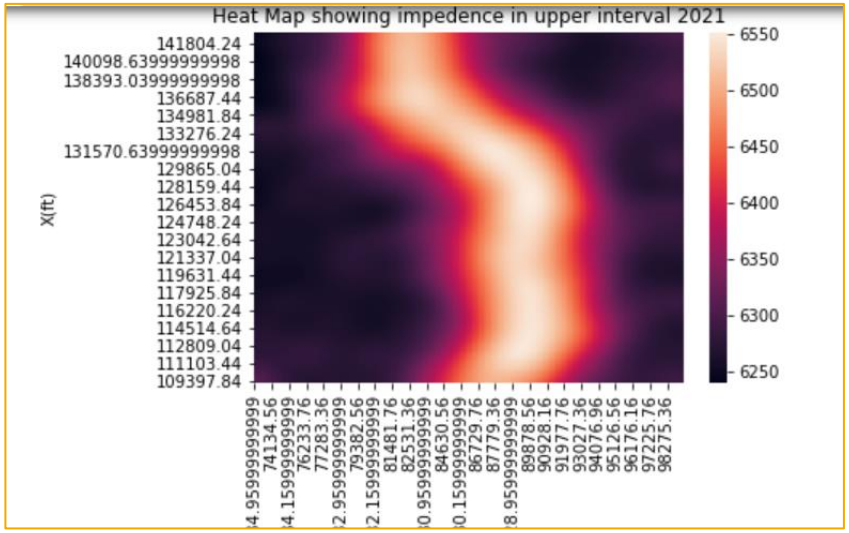
Impedance values for lower and upper interval









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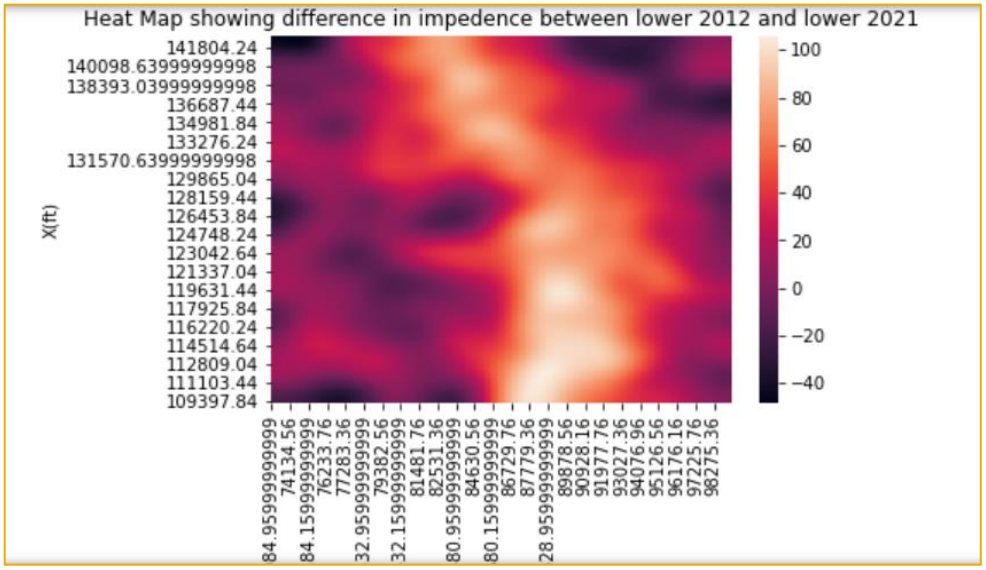
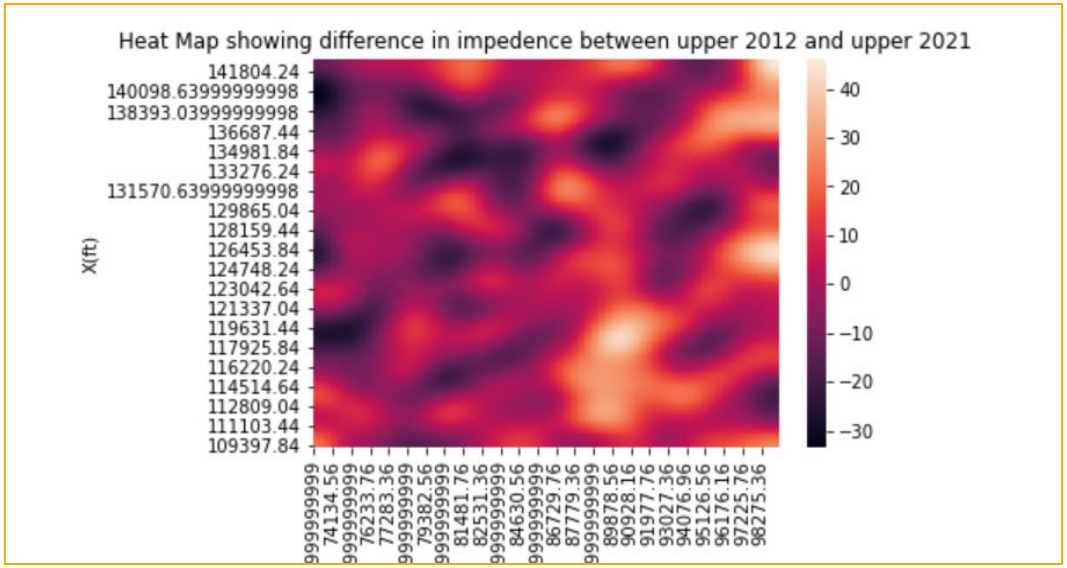
Comparing Impedance difference



The top map shows high impedance difference between 2012 and 2021 in the lower interval



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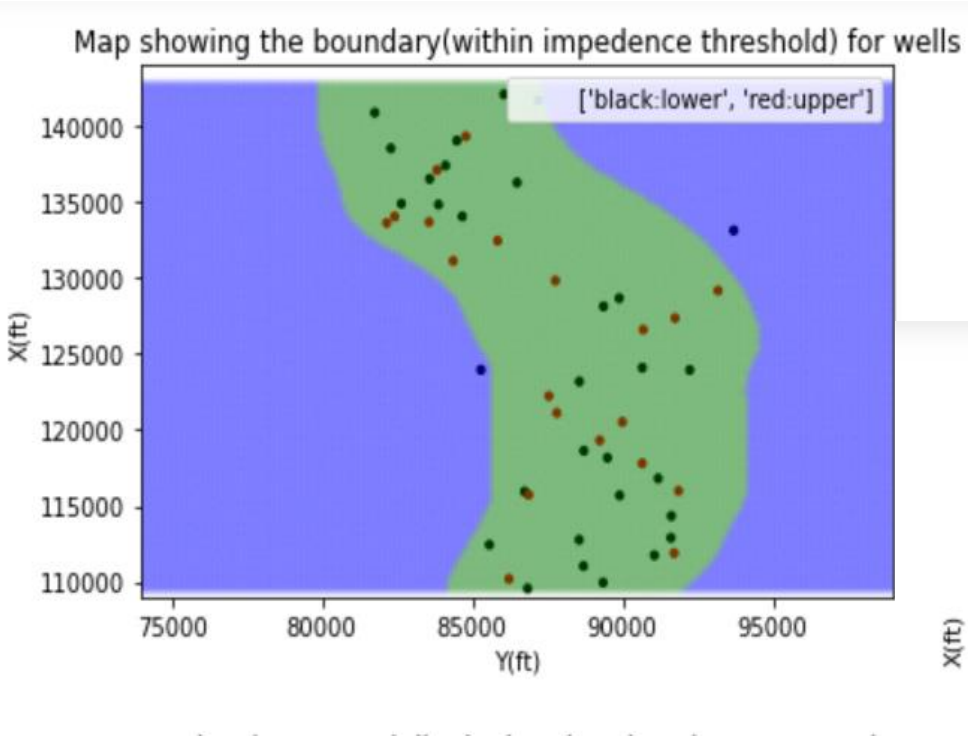
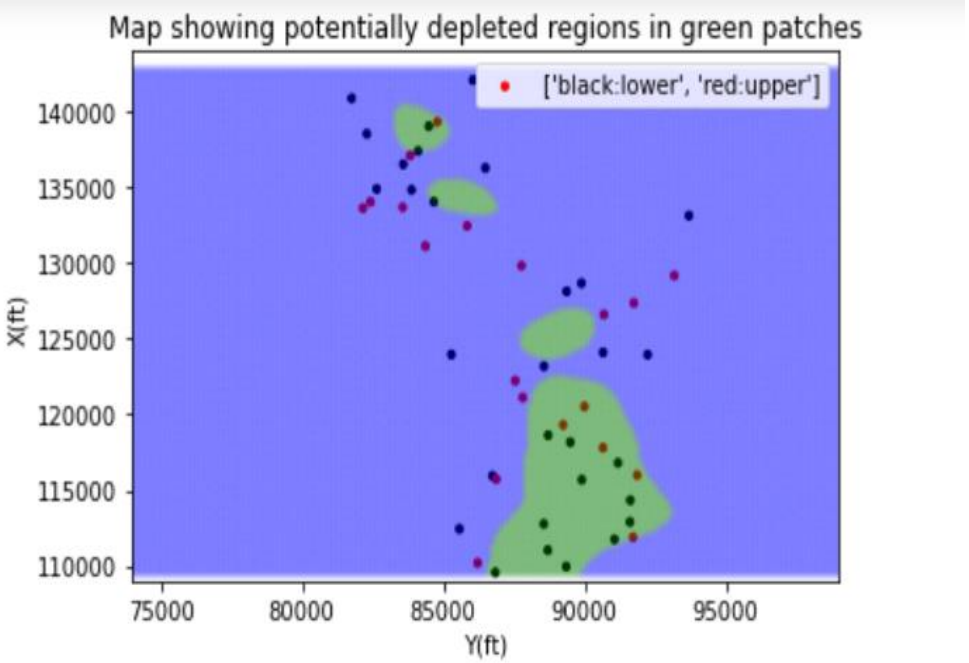
Potentially depleted wells in the Lower interval





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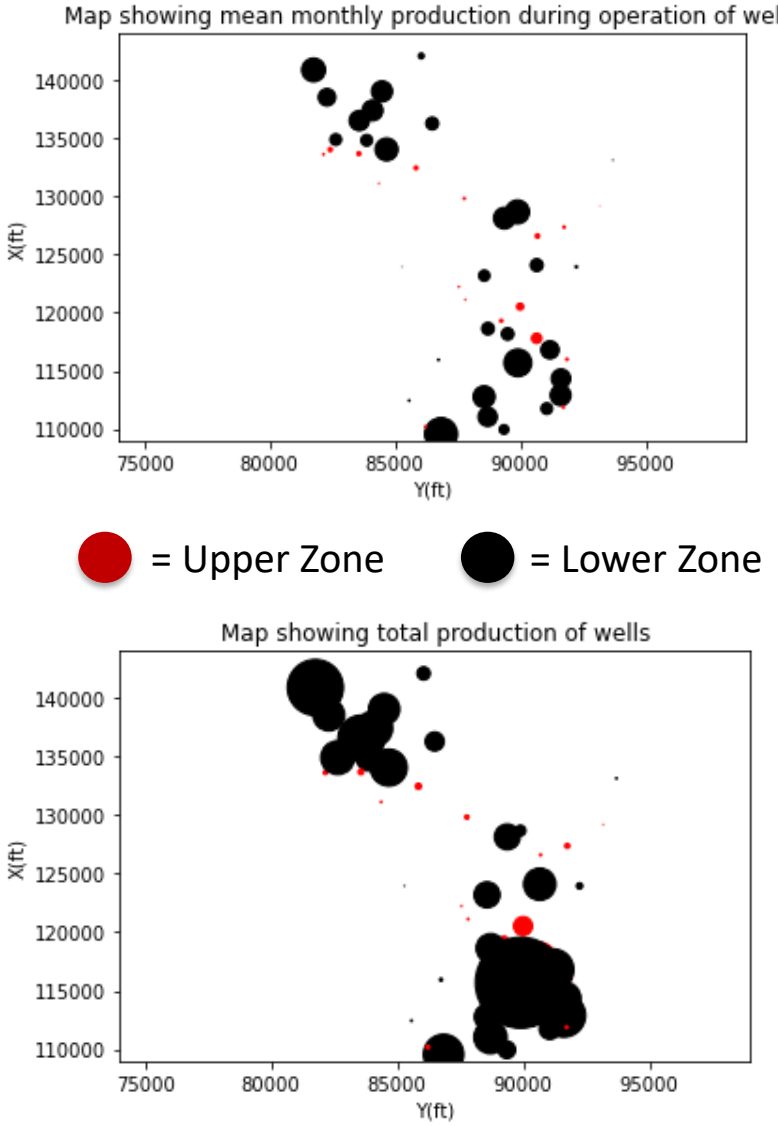
Oil Production Heat Map



- Lower Zone generally has much greater production
  - True for monthly and total production
- Bottom right area has more production
  - True for monthly and total production
- Bottom right area appears to be more used

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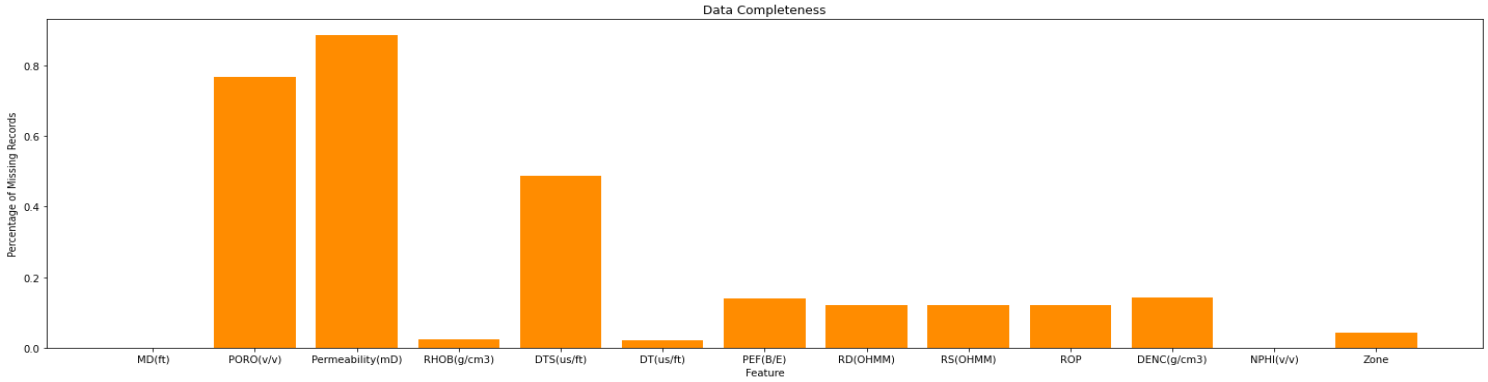
Synthesizing Well Log Data



- Permeability and Porosity are largely missing
- DTS and DENC have lots of data missing as well

WELL		X(ft)	Y(ft)	Elevation Kelly Bushing (ft)	Mean Monthly Prod	Aggregate Production	...	PEF(B/E)	RD(OHMM)	RS(OHMM)	ROP	DENC(g/cm3)	NPHI(v/v)
0	WP0	137106.82	83818.47	193.32	8.809168	475.695080	...	7.374498	NaN	NaN	15.932319	0.061904	0.209666
1	WP1	132460.98	85832.77	187.15	38.675641	1005.566662	...	NaN	176.966978	175.689880	NaN	NaN	0.279190
2	WP2	133634.00	82144.52	164.55	46.363101	1576.345443	...	4.433433	196.608451	188.396267	18.849304	0.017321	0.213481
3	WP3	140892.57	81747.12	179.92	NaN	0.000000	...	7.044380	233.012950	329.287366	15.102250	0.052180	0.134440
4	WP4	109951.43	89343.45	186.21	0.664632	57.822977	...	0.042712	133.065740	213.803551	26.269538	0.042712	0.201439
5	WP5	123950.95	92227.31	172.80	22.342583	1787.406680	...	6.662322	170.883516	277.129193	15.320779	0.059148	0.192889
6	WP6	111035.32	88692.32	182.66	381.194628	17534.952880	...	5.762926	144.473656	173.289089	19.841724	0.058958	0.154997
7	WP7	112439.69	85560.85	181.09	3060.205978	45903.089670	...	NaN	82.461831	83.107373	NaN	NaN	0.340167
8	WP8	127369.74	91739.99	180.04	1221.216449	53733.523750	...	5.907931	145.416383	169.218916	19.972302	0.059421	0.160589
9	WP9	115943.69	86730.44	178.25	1367.727037	17780.451480	...	4.039047	271.416831	234.551988	20.025336	0.011873	0.209172
10	WP10	134042.86	82411.27	184.33	291.086371	27653.205290	...	3.777041	160.471227	120.150161	25.712574	0.010960	0.280983

- Data table made with mean values for all 50 wells
- Production and location data were added to well logs

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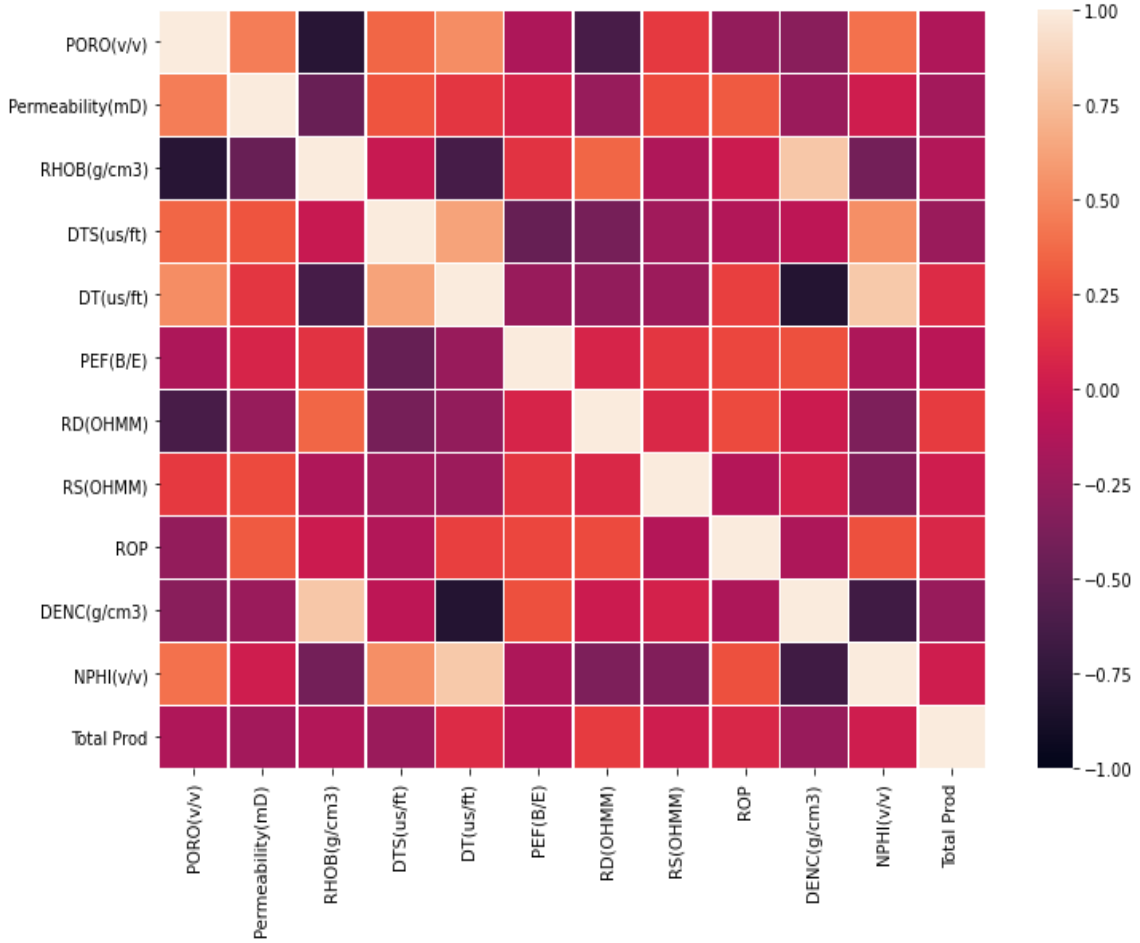
Bivariate Distribution of Features



- Looked for features with high correlation to production
- Features with lots of NaN values were ignored
  - Porosity, Permeability
- Some features were redundant
  - RHOB and DENC

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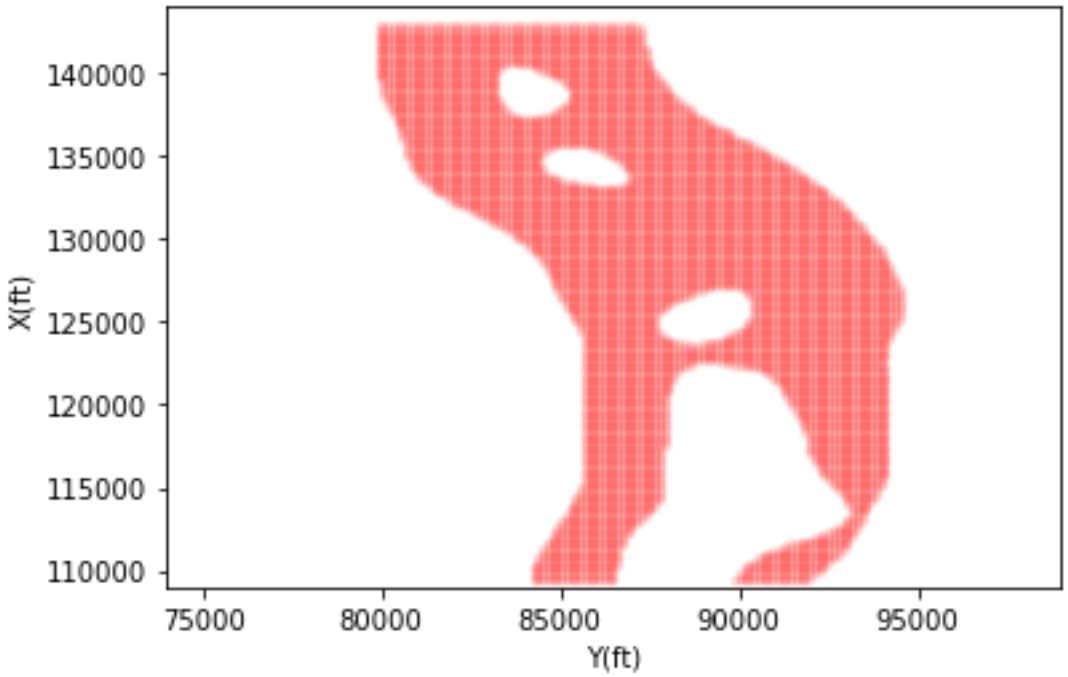
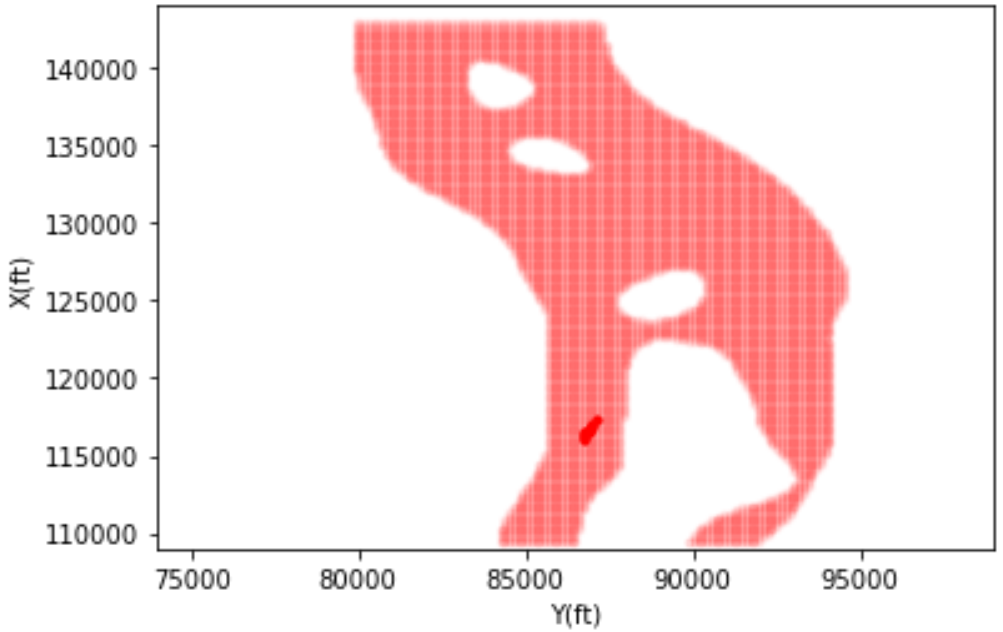
Developing Model



- Performed linear regression to find regression coef.
- 2D interpolation
- Divide AI map into upper and lower zones based on threshold values
- Used maps to find potential well locations based on lower and upper intervals

Results and Discussions

X(ft)	Y(ft)	AI_lower(2012-01-01)	AI_upper(2012-01-01)	AI_lower(2021-12-20)	AI_upper(2021-12-20)	lower_diff_year	upper_diff_year	2-Year Cumulative Production (bbl)	monthly production
109397.84	91846.56	6405.762254	6388.173327	6459.647944	6393.941029	53.885690	5.767702	197969.60346	8248.733478
133145.04	90796.96	6460.794670	6431.957110	6500.954836	6429.005527	40.160167	-2.951583	197969.60346	8248.733478
133145.04	87123.36	6552.622527	6516.945956	6630.098569	6532.484959	77.476042	15.539003	197969.60346	8248.733478



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Feedback

We learned

- How to develop a strategy for managing a large problem
- How to synthesize large batches of data
- How to stay focused for long stretches of time

We enjoyed

- Learning from the different mentors
- The complexity of the problem (partially due to lack of data)
- The strong focus on collaboration

Next year could be improved by

- A slightly longer timeframe
- Allowing groups of up to 5