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800 762 3057

Understanding The Methodology Of Blackbeard Data's Corrected Wellspots
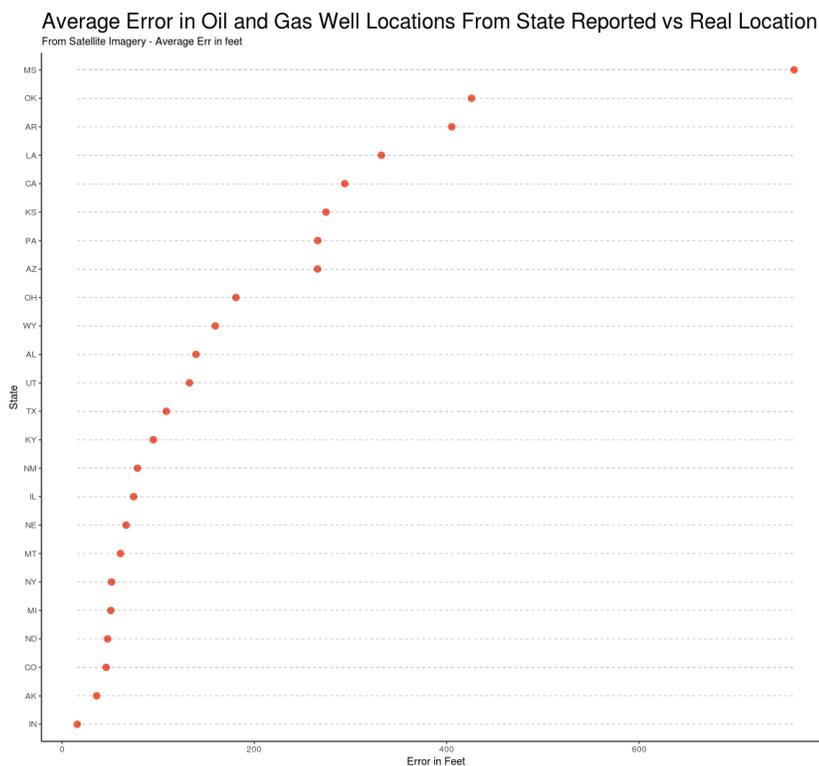
Summary

Across the country, oil and gas well locations are riddled with errors which lead to unintentional mislocations. Drawing on a rich reserve of satellite imagery, state filings, and some artificial intelligence, Blackbeard Data has built a corrected wellspot database of North American Wells. These corrected wells provide better geological information for exploration and production, reservoir analysis, and enhanced oil recovery.

Introduction

Oil and gas continues to shift to higher technologies for exploration. Along the way, better data will be demanded. Among the datasets that will need improvement are wellspots. There are many reasons why wellspots are infamously misplaced. Often caused by typos, or failure to report locations as drilled instead of planned. Ultimately, there is no accountability by the state agencies of the reporting oil company. So with that regulatory oversight, garbage locations can be reported without ramifications. On the other side, most engineers do wish to report correct locations, but there is not a quality assurance check in place to confirm them.

Correcting wellspot locations doesn't just update maps. It updates the geological data of the cores and logs attached to that well. Take for example a well is corrected 900 feet to the Northeast. It can change the minds of geologists, it can

Average Error in Oil and Gas Well Locations From State Reported vs Real Location
From Satellite Imagery - Average Err in feet

source: Blackbeard Data corrected wells, based on over a million corrections using satellite imagery and well plats to find the real locations of wells - blackbearddata.com

show a fault is really over there and not over here, and it can alter the geological understanding to save a company millions by knowing to not drill. Better wellspot accuracy will change isopach maps, geologic cross sections, and reservoir planning.

Blackbeard's Geospatial team solved the problem by correcting over a million wellspots in North America. They did this by creating software that allows wells to be identified from satellite imagery and geocoded to the correct Latitude/Longitude.

Methodology

The traditional method of wellspot correction would be to have a GIS tech research a well, find where the state reports it to be and look at satellite imagery to find it. Once found, it would be corrected in the GIS system. If it was not visible, then it was skipped. If the well was one of several on a multi well pad, then which one of the wells it is would be guessed. Such methodology is slow, and expensive. Not good for old plug and abandoned wells that are lost in time.

Blackbeard's Geospatial team approached this differently. Accuracy is everything, so the method was to train humans to become experts on identification of faded abandoned well pads along with the much easier current producing well pads. The added constraint was to correct wellspots at scale.

The Wellspotters

Blackbeard's approach was called Fingerspitzengefuhl, a German loan word for 'by the touch of ones fingers'. In other words, they are trained to a point where wellspotters could almost do wellspotting by smelling the wells in the satellite image blindfolded. These wellspotters are not GIS experts, instead Blackbeard relied upon detail oriented individuals trained on satellite imagery. They were shown tens of thousands of wellpads across many decades since drilling. 1920's wells, 1950's wells, 1980's wells, etc. Each decade has different aging artifacts on the wellpad that all wellspotters had to learn. In extreme cases of old abandoned well pads from the 1920's, an experienced wellspotter could easily see the trees in the forest were shorter where the pad was, and that the shorter tree area was square. If there was doubt on such a hard pad to ID, then old War Department satellite imagery from the 1940s or 1950's could confirm the wellspotter was correct. However, the usual aid a wellspotter would use is a convenient button that opens a browser to the oil regulatory agency at the state level, linked to the well in question and hopefully a plat will be available. On top of these resources, wellspotters have other proprietary assets to use on top of imagery and plats.

Once the wellspotter has found the true location of the well on a satellite photo, they then assign the correction a confidence grade:
- 4 if they can see the pump jack on a oil well, or the wing valve on a gas well
- 3 if they can see a black spot in the middle of an obvious well pad
- 2 if they can only see a faded well pad
- 1 if they can't find any evidence of a well pad. Wells flagged as '1' then go to the next level to a researcher to find the missing well.

Junior wellspotters had all their wellspots redone independently by a more experienced wellspotter. The results of the two wellspots were compared by the software known as TOM (True

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Orthographic Monster). As all wellspotters get better, TOM would begin to use intelligent metrics to grade the work of wellspotters.

It quickly becomes apparent that the time invested in understanding the local terrain can be re-used. If a wellspotter is spotting wells in forested east Texas, it makes no sense to give that wellspotter a well in North Dakota next, then a well in California, then a well in Mississippi. Instead the wellspotter would be given the nearest well from where they were wellspotting last. This is really useful in not just re-using terrain knowledge, but if a plat was pulled up for a well, that plat would have nearby wells on it which saves much time.
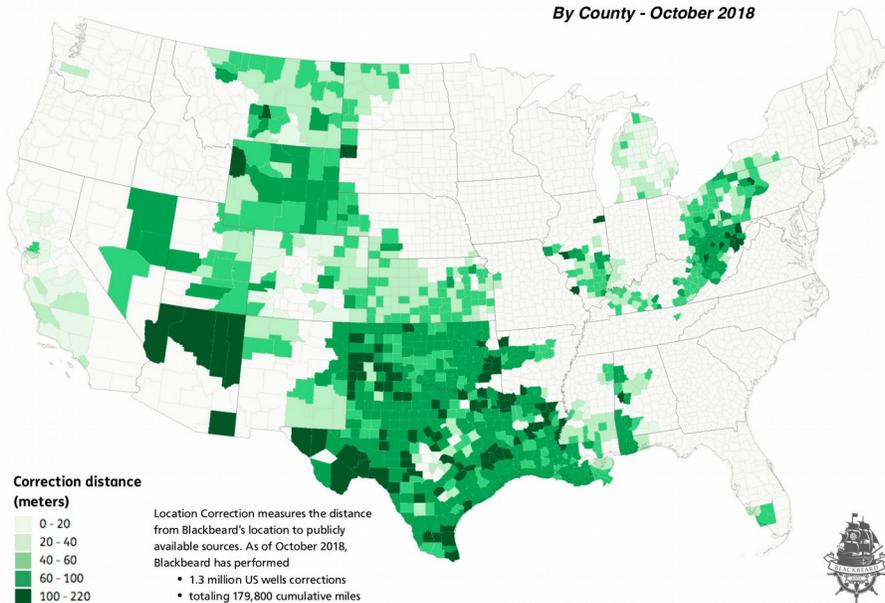
TOM for quality control

TOM is the software that oversees the wellspot correction project at Blackbeard Data. Designed in house to
- Manage Wellspotters
- Divide up workload
- Manage all database storage and logging
- Auto appends new elevation for the location and computes correction distance
- Identify Well Issues
- Used AI for quality control
- Identify Wellspotter work issues
- Report on Progress

TOM runs the project workflow. He doles out the work, and keeps wellspotters in their regions. TOM takes note of how fast work is done, and he records each wellspotters confidence in the correction. If a wellspotter spots wells too fast, which concerns TOM of accuracy, then that spot gets flagged for an admin to review it. If a wellspot is corrected greater than 500 feet, an admin is required to review and confirm it. TOM also flags at random 5% of all spots to be done twice for QC. There are some other QC features that TOM does that are proprietary, but the ultimate result is improved wellspots.

Blackbeard Data Median Wellspot Location Correction
By County - October 2018

Correction distance (meters)
- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 100
- 100 - 220

Location Correction measures the distance from Blackbeard's location to publicly available sources. As of October 2018, Blackbeard has performed
- 1.3 million US wells corrections
- totaling 179,800 cumulative miles

5114 Balcones Woods Dr. PMB 307-288 Austin, TX 78759 | 800 762 3057 | blackbearddata.com

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Accuracy

Satellite imagery is georectified with ground to about an accuracy of 2.5 meters. That is done by the satellite company and Blackbeard Data has no control over that. The accuracy of a wellspotter to drop a dot on the well is usually within 0.5 meters. Internal TOM proprietary methods are applied to mitigate error and the final expected accuracy is about 2 meters or about 6 feet.

Application

Blackbeard Data's Corrected Wellspots identifies the real world location of wells. This in turn will update the well core and log information to better map the geology of a field.

By incorporating corrected wellspots into your geology and reservoir teams you can improve reservoir engineering, and improve the production on new drills.