



Realizing the Smart Grid with Big Data

Tina M. Skagen, director Business Development

6-PAGE SPECIAL POSTGRADUATE SURVIVAL GUIDE 8TH BIRTHDAY ISSUE!

COSMOS

THE SCIENCE OF EVERYTHING

THE END OF VIOLENCE
Steven Pinker on the new peace p.36

DEFEATING POLIO
Will politics jeopardise a cure? p.68

FRAUDS AND FAKES
Science's biggest scams p.24

GENIUS OF DOGS
Inside the canine brain p.41

is data THE NEW GOD?

How tracking your digital trail could predetermine your future – and why you'll benefit from today's data deluge. p.46

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GALAXIES AND NEBULAE • CANCER VACCINES • WHALES • FICTION • REVIEWS

MIT Technology Review

VOL. 10 NO. 1 JANUARY/FEBRUARY 2013



“The mobile phone, the Net, and the spread of information—a deadly combination for dictators”

BIG DATA WILL SAVE POLITICS

BONO: DATA CAN FIGHT POVERTY AND CORRUPTION

SASHA ISSENBERG: DATA MAKES ELECTIONS SMARTER

JOE TRIPPI: DATA PUTS THE SOUL BACK INTO POLITICS

PLUS: OUR LETTER TO PRESIDENT OBAMA

significance

statistics making sense

BIG DATA

SPECIAL ISSUE

DATA AND THE CITY

WHO ARE YOUR FACEBOOK FRIENDS?

MEET THE DATA FAMILY

THEIR EVERY MOVE RECORDED.



POPULAR SCIENCE

THE FUTURE NOW

THE CONTROL CENTERS

Using Data to Feed the World, Solve Cold Cases, Battle Malware, Predict Our Fate

OFFICER ALGORITHM

Can a Crime Be Prevented Before It Begins?

NEW WAYS OF SEEING

A Gallery of Extraordinary Infographics

SPECIAL ISSUE

DATA IS POWER

HOW INFORMATION IS DRIVING THE FUTURE

PLUS: Juan Enriquez Reprograms Life
James Gleick Deciphers the Bit
AND Lawrence Weschler Questions the Cloud


The Economist

14 January 2013 March 15th 2013

Obama the warrior
Misgoverning Argentina
The economic shift from West to East
Genetically modified crops blossom
The right to eat cats and dogs

The data deluge

AND HOW TO HANDLE IT: A 14-PAGE SPECIAL REPORT



Harvard Business Review

OCTOBER 2012

Are You Big Data?
The True Measures Of Success
Michael J. Mandel

10 International Business
10 Rules for Managing Global Innovation
Kathy Wilson and Tracy L. Rice

40 Leadership
What Ever Happened To Accountability?
Thomas H. D'Amico

GETTING CONTROL OF BIG DATA

How vast new streams of information are changing the art of management.

PAGE 55



nature

4 September 2008 www.nature.com/nature £10 THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

THE BITTER BIT
Viral infections for viruses

TROPICAL CYCLONES
The strong get stronger

BLACK HOLE PHYSICS
A new window on the Galactic Centre

BIG DATA

NATUREJOBS
Minnesota musings

Government Executive

GOVERNMENT'S BUSINESS MAGAZINE

MARCH/APRIL 2013

Does Government Ever Really Change?
Page 39

Five Ways Women Get Ahead
Page 43

BIG DATA

HOW IT'S MAKING AGENCIES SMARTER
Page 20



40 ZETTABYTES

[43 TRILLION GIGABYTES]

of data will be created by 2020, an increase of 300 times from 2005



Volume SCALE OF DATA

It's estimated that 2.5 QUINTILLION BYTES

[2.3 TRILLION GIGABYTES]
of data are created each day

Most companies in the U.S. have at least
100 TERABYTES
[100,000 GIGABYTES]
of data stored

The New York Stock Exchange captures

1 TB OF TRADE INFORMATION

during each trading session



By 2016, it is projected there will be

18.9 BILLION NETWORK CONNECTIONS

— almost 2.5 connections per person on earth

Velocity ANALYSIS OF STREAMING DATA

Modern cars have close to
100 SENSORS
that monitor items such as fuel level and tire pressure



The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015
4.4 MILLION IT JOBS
will be created globally to support big data, with 1.9 million in the United States



As of 2011, the global size of data in healthcare was estimated to be

150 EXABYTES
[161 BILLION GIGABYTES]



**30 BILLION
PIECES OF CONTENT**
are shared on Facebook every month



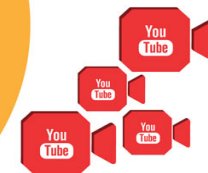
Variety DIFFERENT FORMS OF DATA

By 2014, it's anticipated there will be

**420 MILLION
WEARABLE, WIRELESS
HEALTH MONITORS**



**4 BILLION+
HOURS OF VIDEO**
are watched on YouTube each month



400 MILLION TWEETS
are sent per day by about 200 million monthly active users



1 IN 3 BUSINESS LEADERS

don't trust the information they use to make decisions



Poor data quality costs the US economy around

\$3.1 TRILLION A YEAR

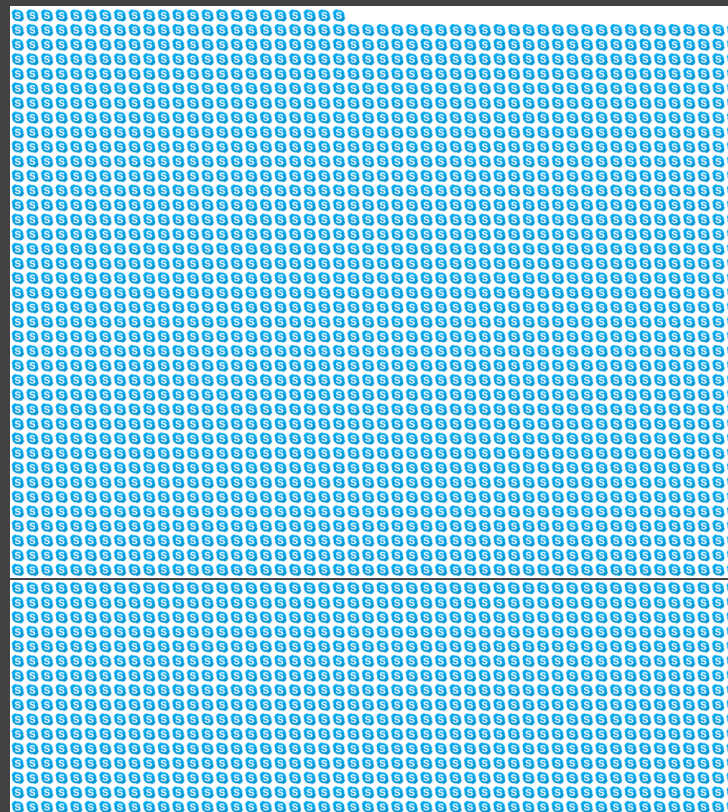


**27% OF
RESPONDENTS**

in one survey were unsure of how much of their data was inaccurate

Veracity UNCERTAINTY OF DATA

2,373 Skype calls

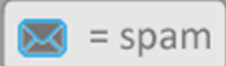




7,433 Tweets sent

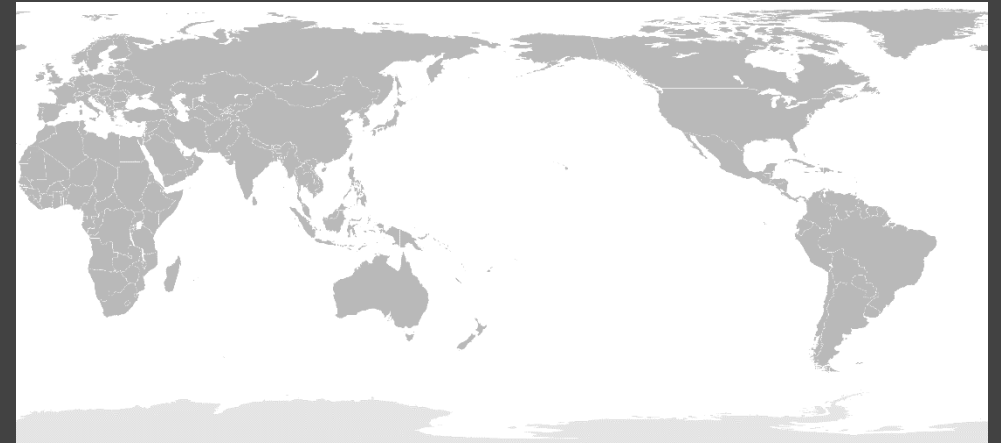
57,587 Google searches

67,319 YouTube videos viewed



2,545,417 Emails sent

1 byte	1 grain of rice
1 kilobyte	1 cup of rice
1 megabyte	8 bags of rice
1 gigabyte	3 container lorries
1 terabyte	2 container ships
1 petabyte	covers Manhattan
1 exabyte	Covers the UK – three times
1 zettabyte	Fills the Pacific Ocean



We will generate enough data
by 2020 to fill the Pacific Ocean
every day

At the moment **less than 0.5 %** of all data is ever analyzed and used.

Artificial intelligence and machine learning

Simplified machine learning process

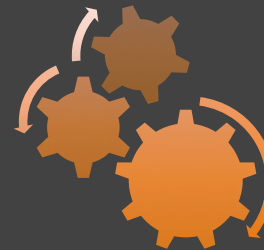
Question / objective



Data and examples

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Date/Time	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	Z11	Z12
2	1/1/2004 0.30	16853	126259	136233	484	6829	133088	136233	3124	75243	23339	90700	86699
3	1/1/2004 1.30	16450	123113	133055	457	6596	129909	133055	2956	67368	22100	86699	86699
4	1/1/2004 2.30	16517	119192	128608	400	6525	125737	128608	2953	64050	21176	84243	84243
5	1/1/2004 3.30	16873	127607	126793	448	6654	124562	126793	2914	63861	21135	84243	84243
6	1/1/2004 4.30	17064	118343	127692	444	6977	125320	127692	3221	75852	21564	86087	86087
7	1/1/2004 5.30	17727	121228	130805	490	7330	128558	130805	3361	79989	22241	90210	90210
8	1/1/2004 6.30	16374	126771	136743	533	7799	134124	136743	3506	80079	22937	94370	94370
9	1/1/2004 7.30	19355	132289	142741	581	8303	140593	142741	3904	75852	23666	98218	98218
10	1/1/2004 8.30	19534	139941	150997	612	9190	149131	150997	4154	69552	24110	102024	102024
11	1/1/2004 9.30	18611	141950	151165	633	9546	151466	151165	4210	69888	24116	102476	102476
12	1/1/2004 10.30	17666	145109	156573	633	9814	154523	156573	4225	66549	23718	101344	101344
13	1/1/2004 11.30	16374	144759	156195	599	8915	153673	156195	4203	65625	22770	98486	98486
14	1/1/2004 12.30	15106	141311	152713	559	8318	148849	152713	4080	65604	21866	93564	93564
15	1/1/2004 13.30	14455	131288	141818	546	7812	140720	141818	3950	65877	20771	88504	88504
16	1/1/2004 14.30	13518	127683	137770	526	6858	134540	137770	3774	65667	20122	84515	84515
17	1/1/2004 15.30	13138	126829	136849	507	6635	133465	136849	3753	65625	20073	83058	83058
18	1/1/2004 16.30	14130	135163	145842	560	7220	142283	145842	3903	64932	21130	88229	88229
19	1/1/2004 17.30	16409	155436	167715	619	8058	164293	167715	4348	66129	24825	105060	105060
20	1/1/2004 18.30	18150	157850	170321	693	9179	167029	170321	4608	65121	26427	111298	111298
21	1/1/2004 19.30	18235	156840	169230	663	9105	165945	169230	4332	64911	26461	112727	112727
22	1/1/2004 20.30	17935	153154	164570	637	8771	161216	164570	4272	64911	26300	111613	111613
23	1/1/2004 21.30	16904	146976	158587	605	8222	155197	158587	3904	63552	25178	107922	107922
24	1/1/2004 22.30	16162	137713	148592	550	7805	140518	148592	3527	73605	23826	101311	101311
25	1/1/2004 23.30	14750	128023	138138	522	6836	134460	138138	3188	76482	22026	93204	93204
26	1/2/2004 0.30	14155	123452	131206	481	5903	129356	131206	3003	76545	20564	86863	86863
27	1/2/2004 1.30	14038	122307	131970	438	5678	127985	131970	2847	80850	20121	82206	82206
28	1/2/2004 2.30	14019	122181	131833	447	5719	127900	131833	2852	80850	19794	79782	79782
29	1/2/2004 3.30	14489	123462	131152	439	5710	129117	131152	2903	81165	19643	78682	78682
30	1/2/2004 4.30	14920	125753	135687	448	5963	131714	135687	3036	80619	20647	80051	80051
31	1/2/2004 5.30	16072	136545	147333	485	6480	140225	147333	3252	79842	22806	84357	84357
32	1/2/2004 6.30	17800	148228	159918	534	7069	155296	159918	3527	68664	24602	91493	91493
33	1/2/2004 7.30	19089	162001	174799	549	7713	169714	174799	3774	68229	26422	97086	97086
34	1/2/2004 8.30	19577	170452	183919	573	8100	178553	183919	3750	66801	27309	101162	101162
35	1/2/2004 9.30	20647	177574	191603	618	8443	185717	191603	3910	67095	28473	103732	103732
36	1/2/2004 10.30	19770	177483	191504	599	7998	185481	191504	3950	66549	28774	103744	103744
37	1/2/2004 11.30	18564	175004	188829	556	7648	182652	188829	3926	65730	28102	101208	101208
38	1/2/2004 12.30	14533	126330	136233	484	6829	133088	136233	3124	75243	23339	90700	90700

Learning algorithm



Predictive model ... answers the question on new data



NVIDIA Titan X GPU
250W
26cm x 11cm x 4cm



NEC Earth
Simulator

Worlds fastest
supercomputer from
2002 to 2004

Used 6.4 MW of
power (plus air
conditioning)

Housed in a two-
story building
65m x 50m x 17m



Trained machine
learning models
represent the digital
intelligence in our
solutions

Digital
intelligence



The models are
implemented in our
cloud based, digital
platform

Digital
intelligens

Data
engineering



Innovative solutions
to realize efficiency
gains and savings
for customers



The power utilities face massive changes

Aging
infrastructur
e

Regulatory
changes

Distributed
energy
resources
and
prosumers

Severe
weather and
expensive
power
outages

The result is
massive
investments, and
comprehensive
**operations and
maintenance**

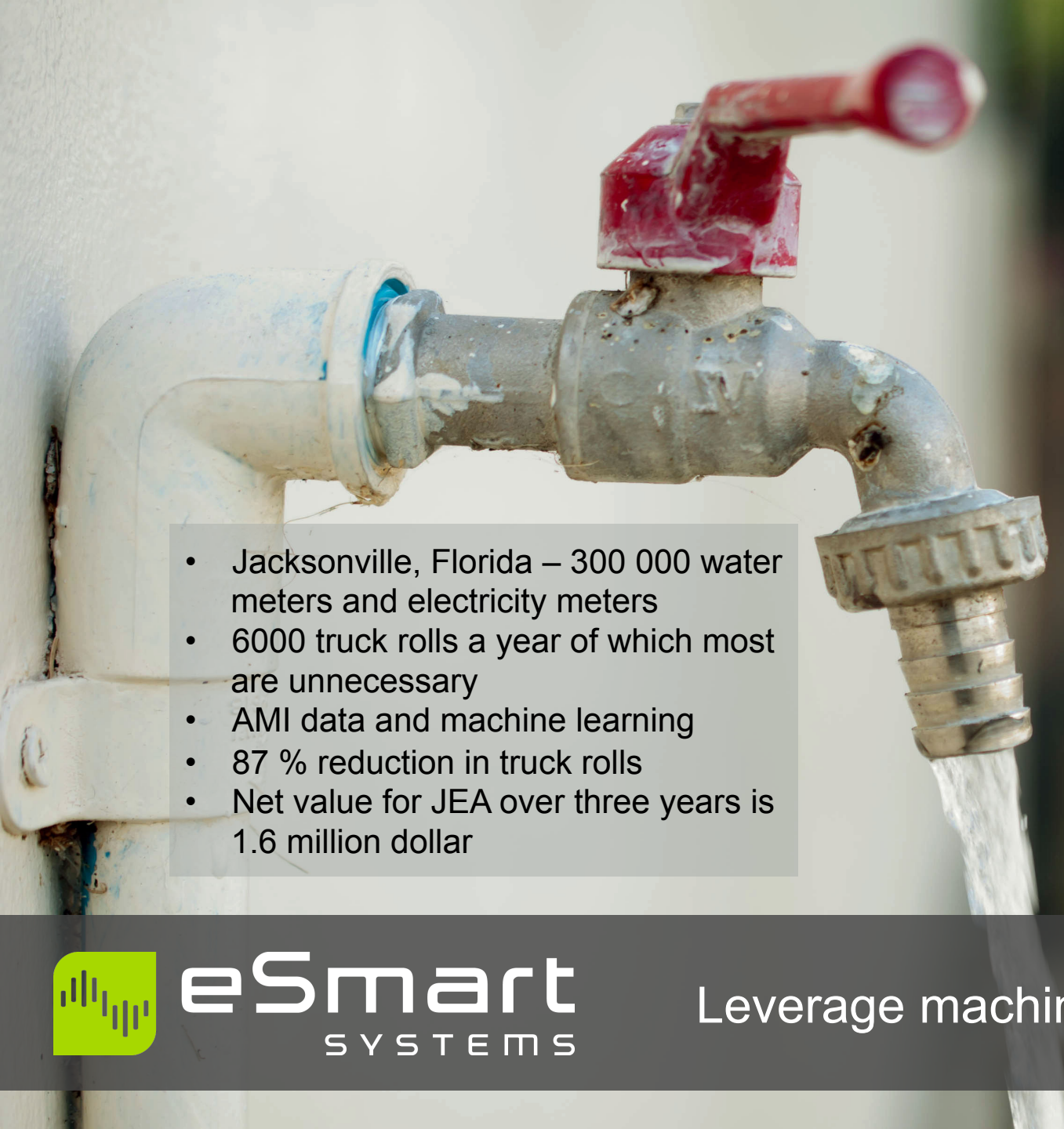
What **if**...



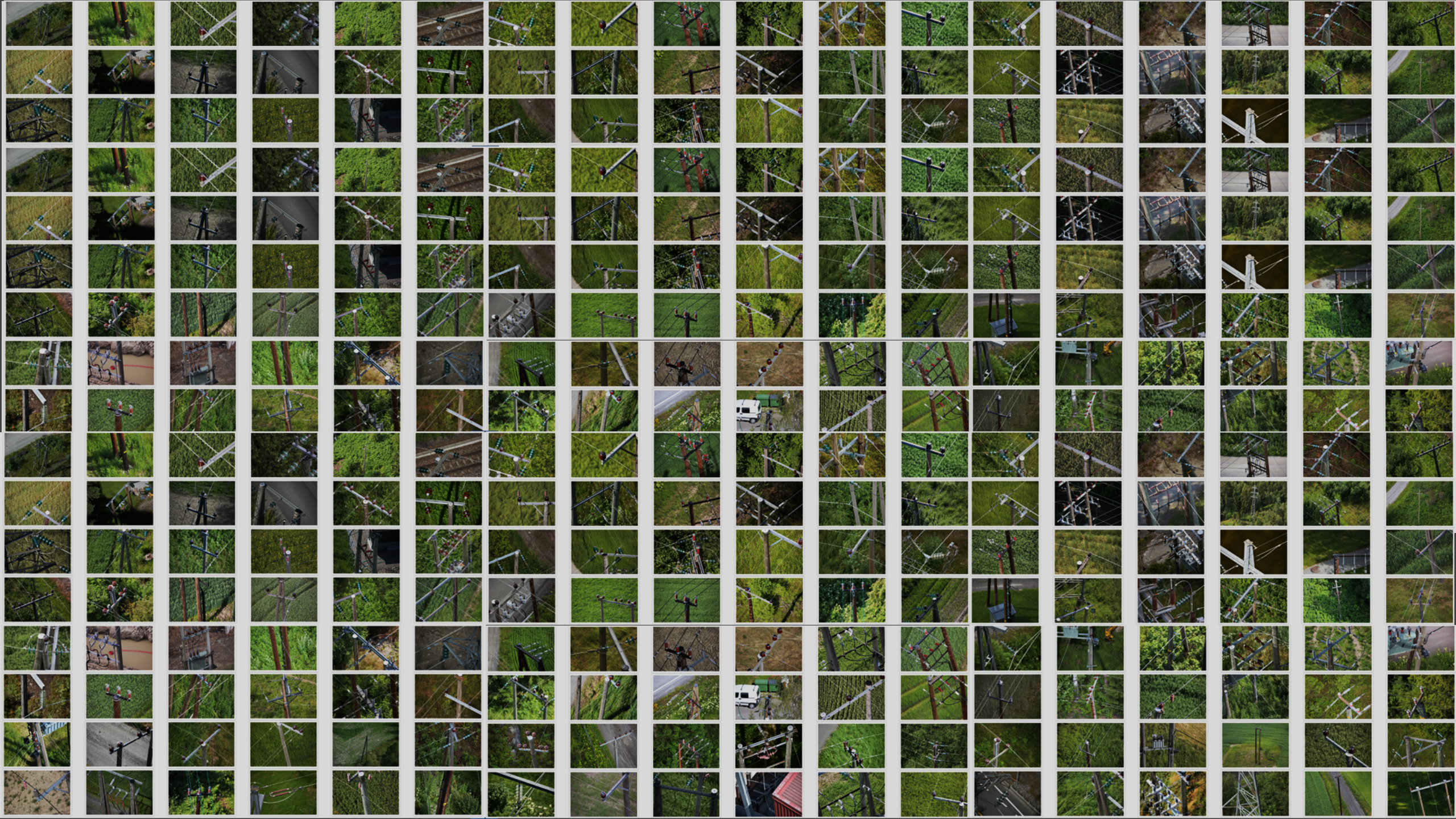
eSmart
SYSTEMS

Intelligent asset management to ensure planning, operations,
and maintenance of the power grid



- 
- Jacksonville, Florida – 300 000 water meters and electricity meters
 - 6000 truck rolls a year of which most are unnecessary
 - AMI data and machine learning
 - 87 % reduction in truck rolls
 - Net value for JEA over three years is 1.6 million dollar












eSmart
SYSTEMS

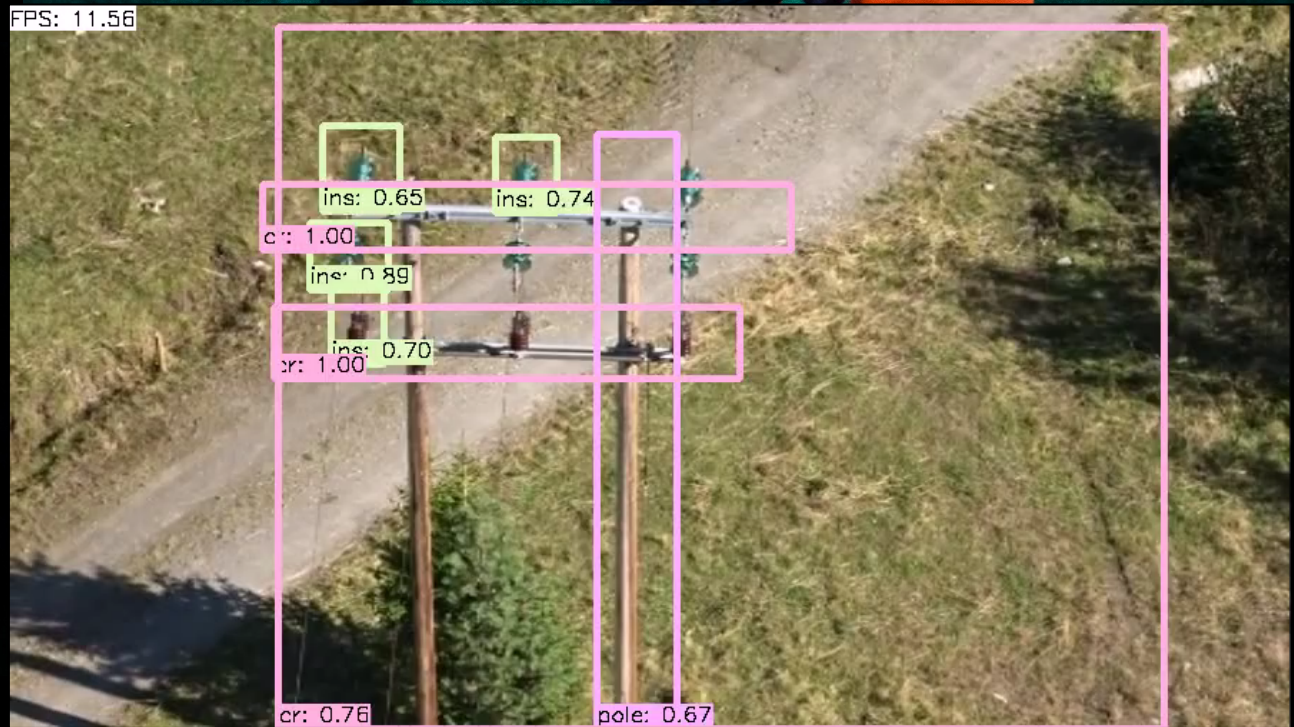
Today's inspections are time-consuming,
risky, and manual



-  Video
-  Images
-  Infrared
-  Radio noise
-  Lidar/3D



eSmart
SYSTEMS



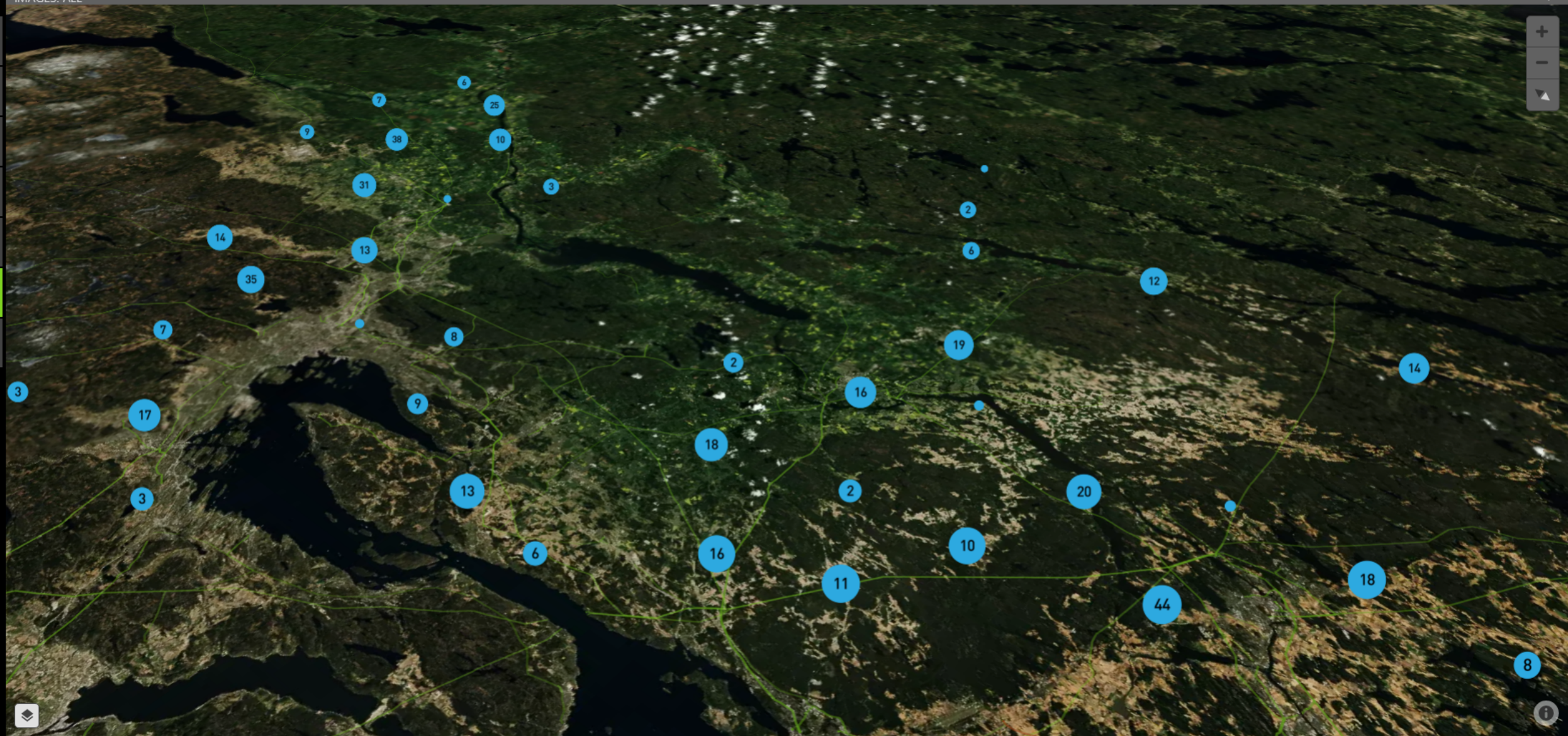
LOADED IMAGES

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5714 images

FILTER BY COMPANY

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20160518164717_1.jpg

May 18th 2016

LNG: 18.457166666666666

LAT: 69.22126666666666



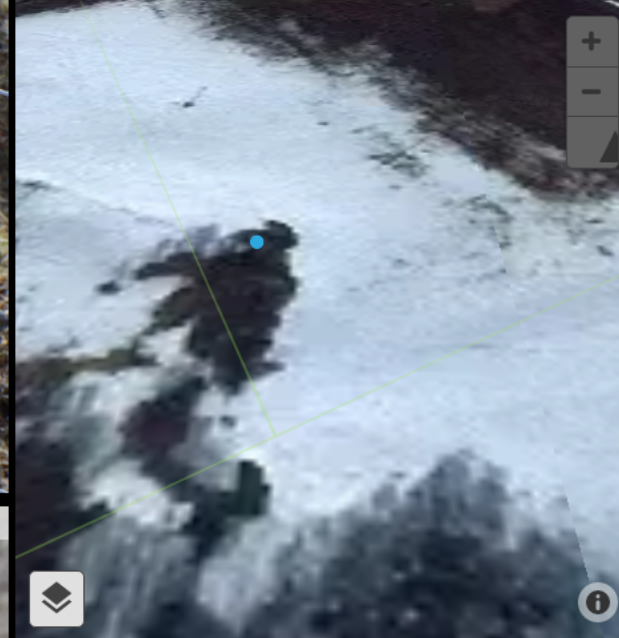
20160518143756.jpg



COMPONENTS

- Crossarm
- Brown 4-disc porcelain insulator - line through top track
- Pole
- Toppad
- Brown 4-disc porcelain insulator - line through top track
- Brown 4-disc porcelain insulator - line through top track

LOCATION



Crossarm



Brown 4-disc porcelain insulator - line through top track



Pole



Toppad



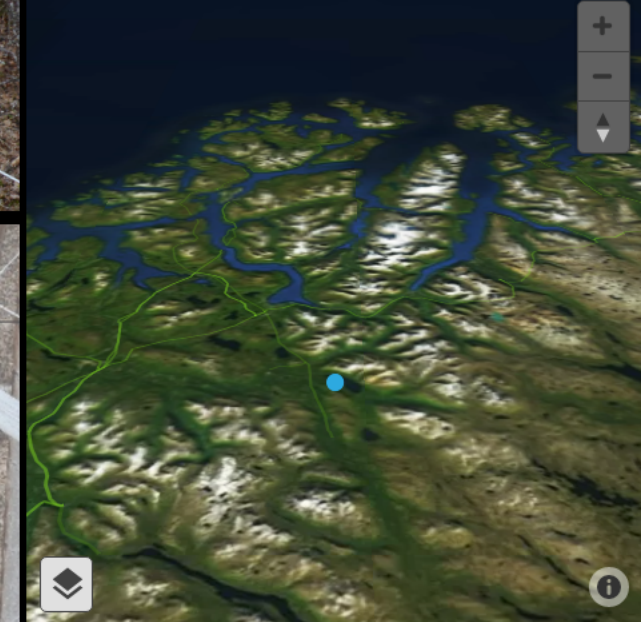
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COMPONENTS

- Crossarm
- Pole
- Brown 4-disc porcelain insulator - line on side of top
- Crossarm
- Toppad
- Pole
- 2-disc glass insulator
- Pole
- Brown 4-disc porcelain insulator - line through top track
- Pole
- Toppad
- Toppad
- 2-disc glass insulator
- Brown 4-disc porcelain insulator - line through top track

LOCATION



IMAGES ANALYZED

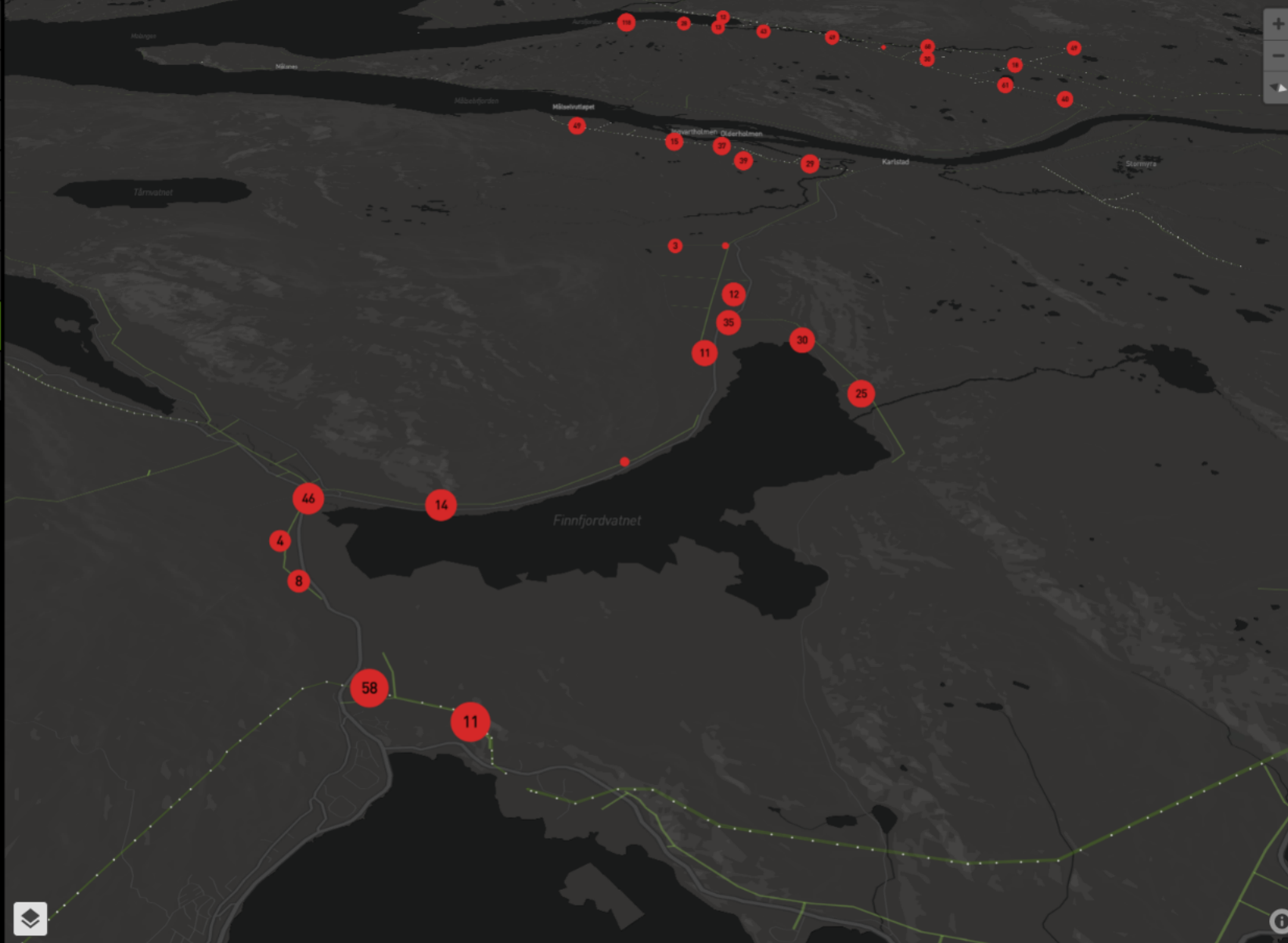
5715 images

COMPONENTS IDENTIFIED

37299 components

ERRORS: ALL

COMPONENT TYPES IDENTIFIED



Brown 4-disc porcelain insulator - line through top track
Counter: 9260

Pole
Counter: 7397

Crossarm
Counter: 4830

Toppad
Counter: 6101

Insulator - unclassified
Counter: 5024

Brown 4-disc porcelain insulator - other
Counter: 1065

Brown 4-disc porcelain insulator - line on side of top
Counter: 2127

2-disc glass insulator
Counter: 628

3-disc glass insulator
Counter: 746

9-disc white insulator
Counter: 105

9-disc orange insulator
Counter: 16

IMAGES ANALYZED

5715 images

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37299 components

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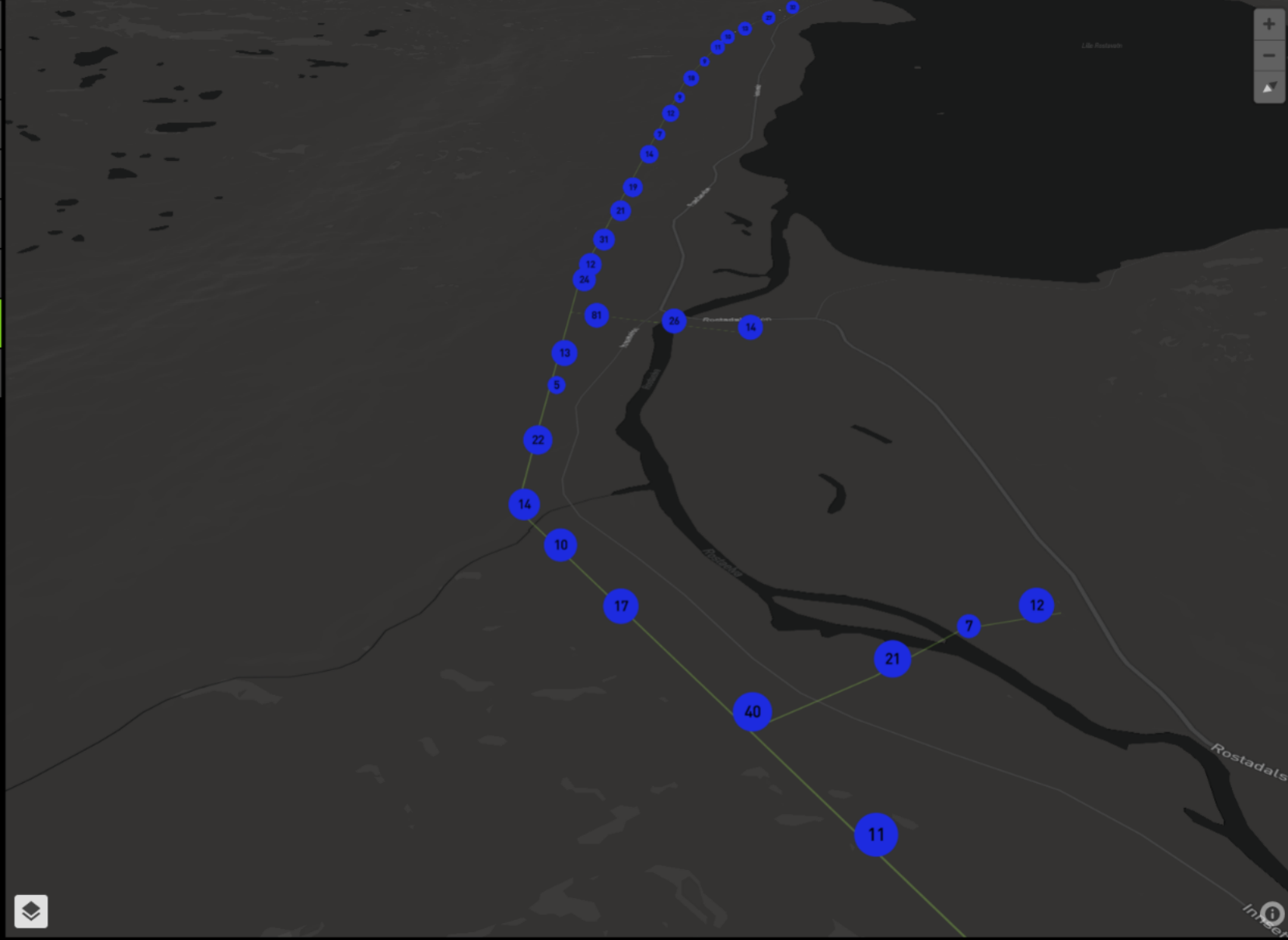
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Counter: 2127

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9-disc white insulator
Counter: 105

9-disc orange insulator
Counter: 16



POWERED BY VALUES

Thank you

Tina M. Skagen
T: 995 89 577
E: tina.skagen@esmartsystems.com