



NANYANG
TECHNOLOGICAL
UNIVERSITY
SINGAPORE

XplorEEE: Foundation of Data Science in Python

Instructors:

Ho Mun Kit

Zhuang Huiping

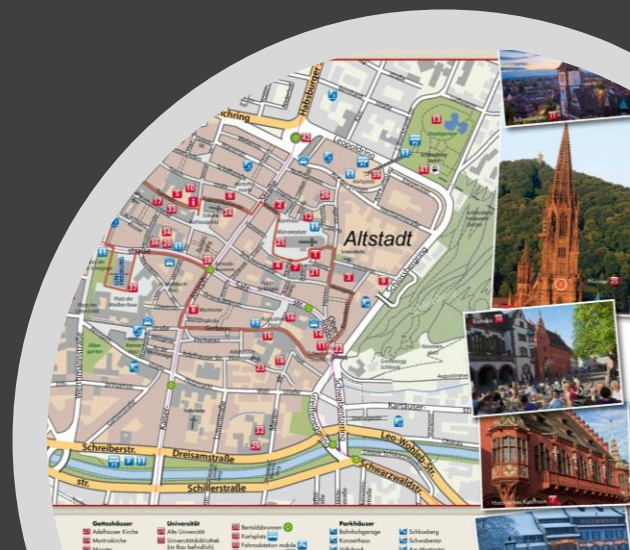


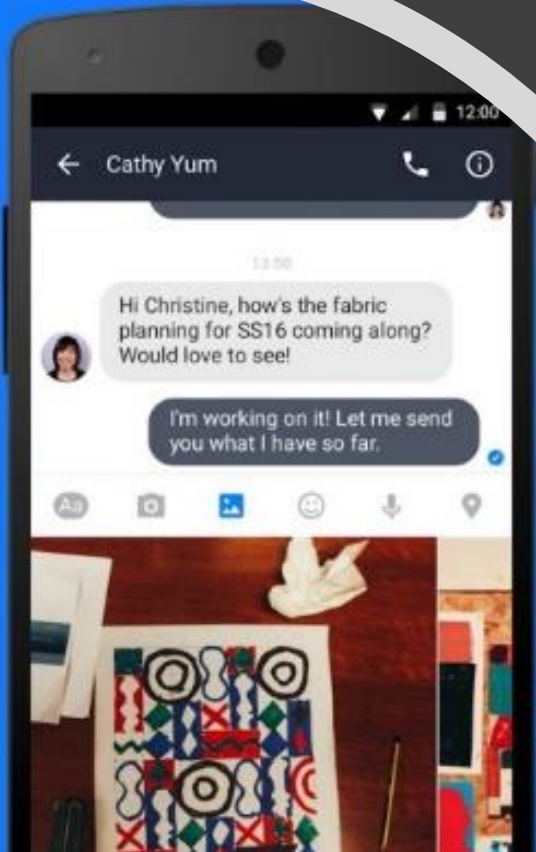
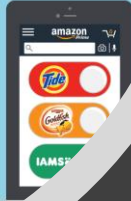
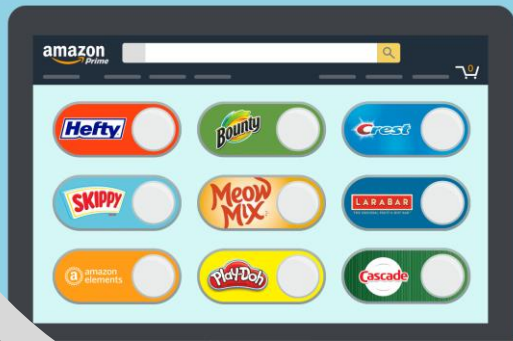
Program Schedule

Time	Program
09:00 – 09:30	Introduction: What is Data Science
09:30 – 11:00	Introduction: Python Basics
11:00 – 12:00	Python libraries for Data Science
12:00 – 13:00	Hands-on: Linear Regression



Data and information
from places you hardly notice





We are consuming and generating data every day

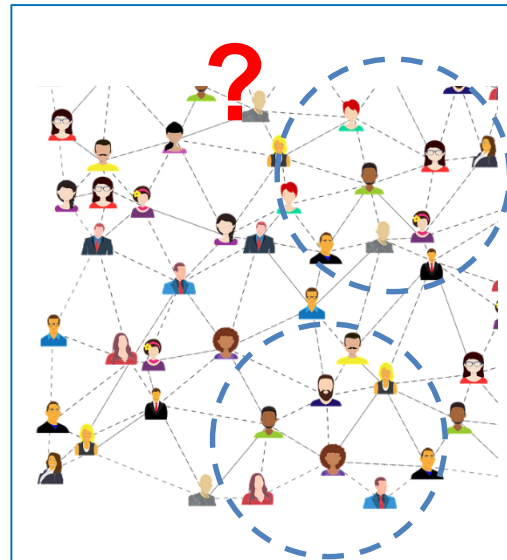


Data science

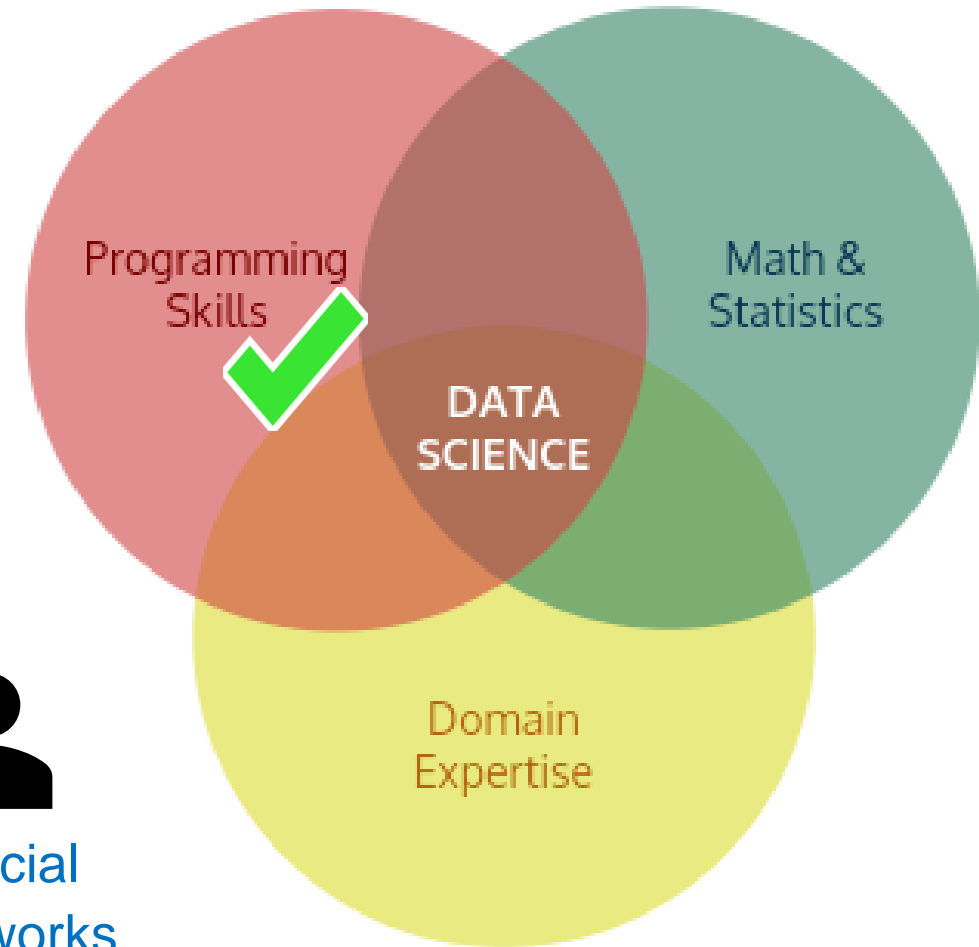
Exploration and analysis of data in order to discover meaningful patterns to answer critical questions




Advertising




Social
Networks



Data

Information

Knowledge



Angular Forms Fields Validation

Name *

Please inform your name

Email *

Please inform your email

Address *

Please inform your address

Address 2

Zip Code *

Please inform your zipCode

City *

Please inform your city

State / Province / Region *

Please inform your state

Country *

Please inform your country

Submit Reset

Number	GivenName	MiddleInitial	Surname	Gender	StreetAddress	City	State	ZipCode	Cc
1	Bruce	R	Bloch	male	3151 Ferrell Street	Argyle	MN	56713	US
2	Marie	E	Humphreys	female	3062 Bond Street	Woonsocket	RI	2895	US
3	Sylvia	H	Carter	female	1481 Lakeland Terrace	Westland	MI	48185	US
4	William	E	Bentz	male	3318 Briercliff Road	New York	NY	10011	US
5	Shelly	R	Preston	female	3592 Todds Lane	San Antonio	TX	78212	US
6	Chad	P	Henry	male	3553 Grant Street	Tyler	TX	75702	US
7	David	L	Richardson	male	1289 Metz Lane	Marlton	NJ	8053	US
8	Stephen	A	Pond	male	4316 Bridge Avenue	Lafayette	LA	70503	US
9	Jenny	P	Thomas	female	2941 Harron Drive	Baltimore	MD	21202	US
10	William	V	Fries	male	4300 Tanglewood Road	Jackson	MS	39201	US
11	Julio	D	Bessette	male	4177 Lauren Drive	Madison	WI	53718	US
12	Jerry	J	Nicholas	male	2722 Elk Street	Irvine	CA	92718	US
13	Thomas	A	Hunter	male	4112 Stadium Drive	Franklin	MA	2038	US
14	Edmund	C	Chagoya	male	3685 Essex Court	Brattleboro	VT	5301	US
15	David	E	Meador	male	1215 Stratford Drive	Kona	HI	96740	US
16	Joan	L	Mayfield	female	3137 Pin Oak Drive	Whittier	CA	90603	US
17	Maria	H	Gomez	female	1723 Yorkie Lane	Richmond Hill	GA	31324	US
18	Gregory	G	Miguel	male	3233 Breezewood Court	Macksville	KS	67557	US
19	Gail	L	Griffin	female	2252 Arbutus Drive	Miami	FL	33179	US



OBJECTIVE: Extract knowledge to automate decision-making of identical problems in the future



THE TWO STATES OF EVERY PROGRAMMER



I AM A GOD.

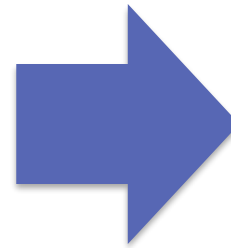


**I HAVE NO IDEA
WHAT I'M DOING.**

PROGRAMMING

How do I tell a computer to accomplish a certain task?

Exercise: How do I cook this pack of noodles?



Tips:

- What do you need?
- Which indicators do you look out for?

Noodles in
packaging



?



...



?



Ready to eat

Quick hands-on: Robot Guidance



Link: <https://bit.ly/1zlvq2z>

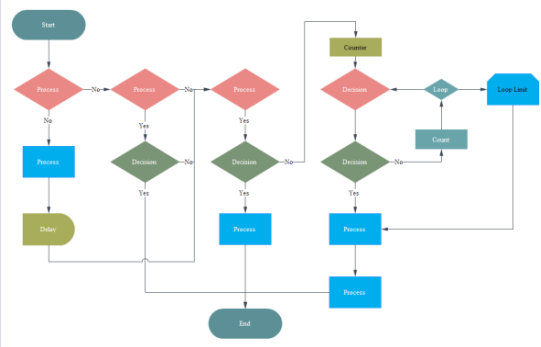
Classic software

Decompose
the problem

Design
algorithms

Integrate into
a system

Measure
performance



```
1 import clr
2 clr.AddReference("RevitServices")
3 import RevitServices
4 from RevitServices.Persistence import DocumentManager
5 from RevitServices.Transactions import TransactionManager
6 doc = DocumentManager.Instance.CurrentDBDocument
7
8 clr.AddReference("RevitNodes")
9 import Revit
10 clr.ImportExtensions(Revit.Elements)
11 clr.ImportExtensions(Revit.GeometryConversion)
12
13 from Autodesk.Revit.DB import *
14
15 clr.AddReference("System")
16 from System.Collections.Generic import List as cList
17
18 elements = UnwrapElement(toList(IN[0]))
19 famtypepairs = IN[1]
20
21 def numerotation(elements, famtypepairs):
22     n=0
23     for elmt in elements:
24         if elmt.Type == famtypepairs:
25             Element.SetParameterByName(elmt, "Numerotation palplanches", StringFromObject(n+1, "-"), n+1)
26         n=n+1
27     return n
28
29 TransactionManager
30 OUT = 0
31 TransactionManager
```



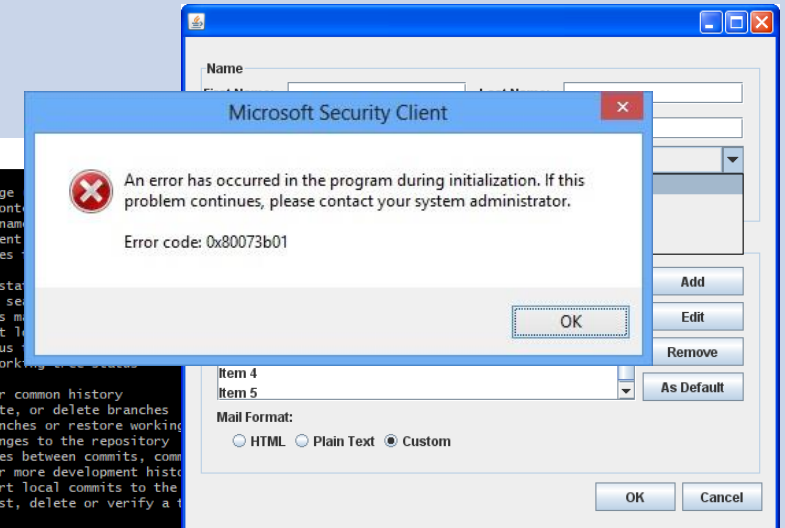
```
root@DELTA9935: ~
work on the current change
add      Add file contents from the working tree
mv       Move or rename a file, a directory or a symlink
reset    Reset current index to HEAD
rm       Remove files from the working tree and the index

examine the history and status
bisect   Use binary search to find the commit that introduced a bug
grep     Print lines matching a pattern
log      Show commit logs
show     Show various information about files
status   Show the working tree status

grow, mark and tweak your common history
branch   List, create, or delete branches
checkout Switch branches or restore working tree files
commit   Record changes to the repository
diff     Show changes between commits, commit and working tree, two files, or two
commits
merge    Join two or more development histories together
rebase   Forward-port local commits to the latest upstream version
tag      Create, list, delete or verify a tag name

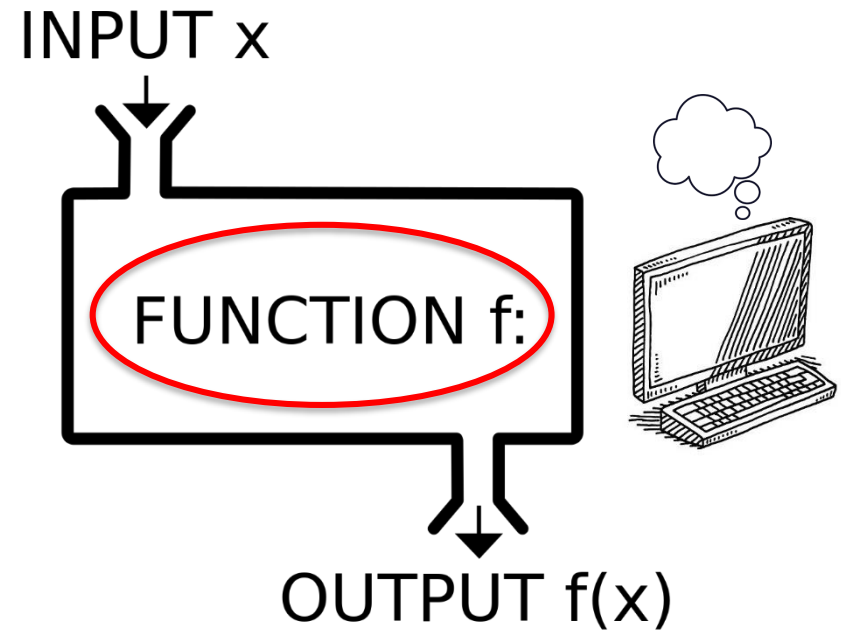
collaborate (see also: git help workflows)
fetch    Download objects and refs from another repository
pull     Fetch from and integrate with another repository or a local branch
push     Update remote refs along with associated objects

'git help -a' and 'git help -g' list available subcommands and some
concept guides. See 'git help <command>' or 'git help <concept>'
to read about a specific subcommand or concept.
```



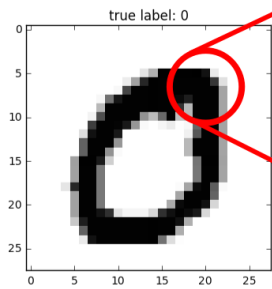
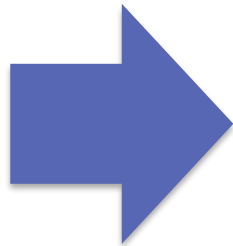
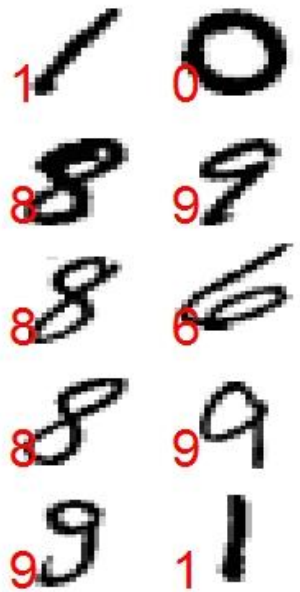
SOFTWARE 2.0

Machine learning algorithms



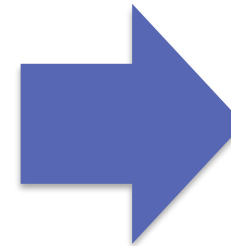
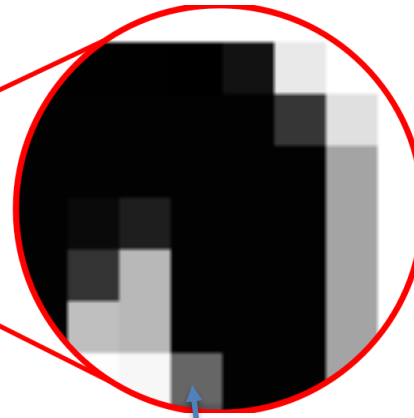
Programming a more complex task

Handwriting
recognition
task

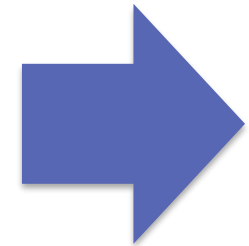


$$\vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_m \end{bmatrix}$$

Each 8-bit pixel
takes the value of
0-255



Classifier
algorithm

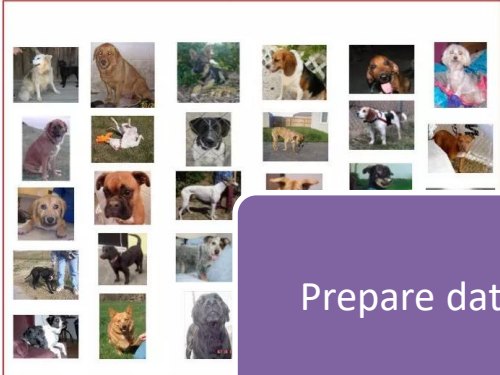
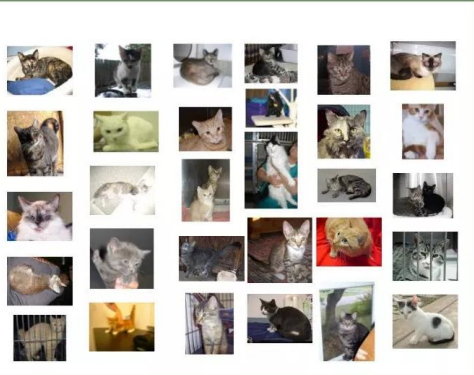


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Machine Learning Algorithms

Cats

Dogs



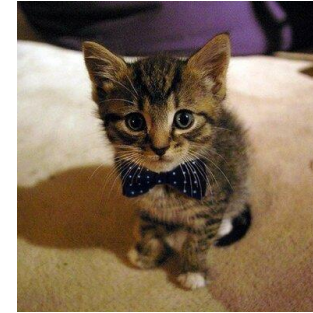
Prepare data

Hypothesis: $h_{\theta}(x) = \theta_0 + \theta_1 x$

Parameters: θ_0, θ_1

Select hypothesis function

Specify desirable goal



CAT

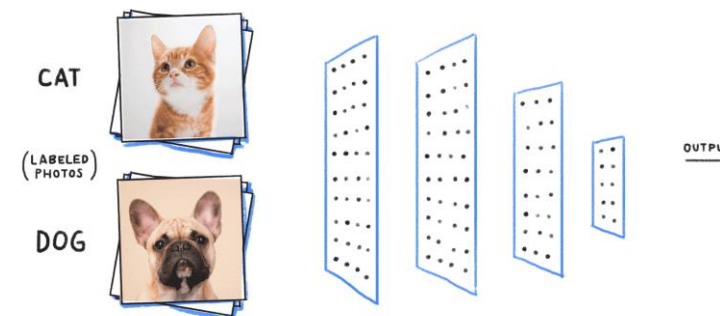


CAT



Computer searches for a program/function

Measure performance



ML/AI APPLICATIONS IN REAL WORLD



ML/AI applications in real world

- So, how do you actually use ML/AI?

Where do you collect the data from? How do you use it to solve problems of the real world?



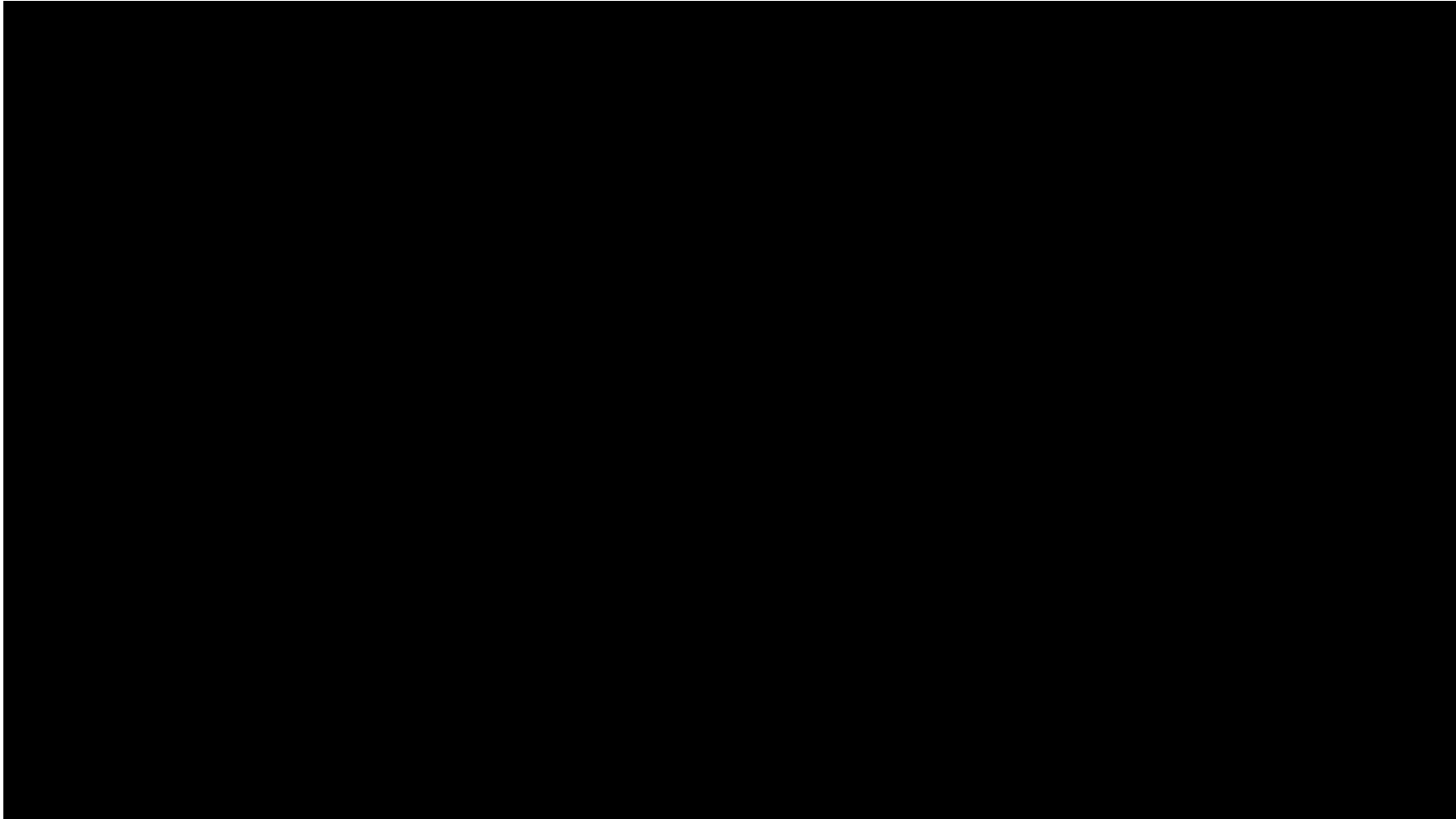
ML/AI applications in real world

- So, how do you actually use ML/AI?
Where do you collect the data from? How do you use it to solve problems of the real world?

Signals → Sensors → Data → ML



ML and Signal Processing?

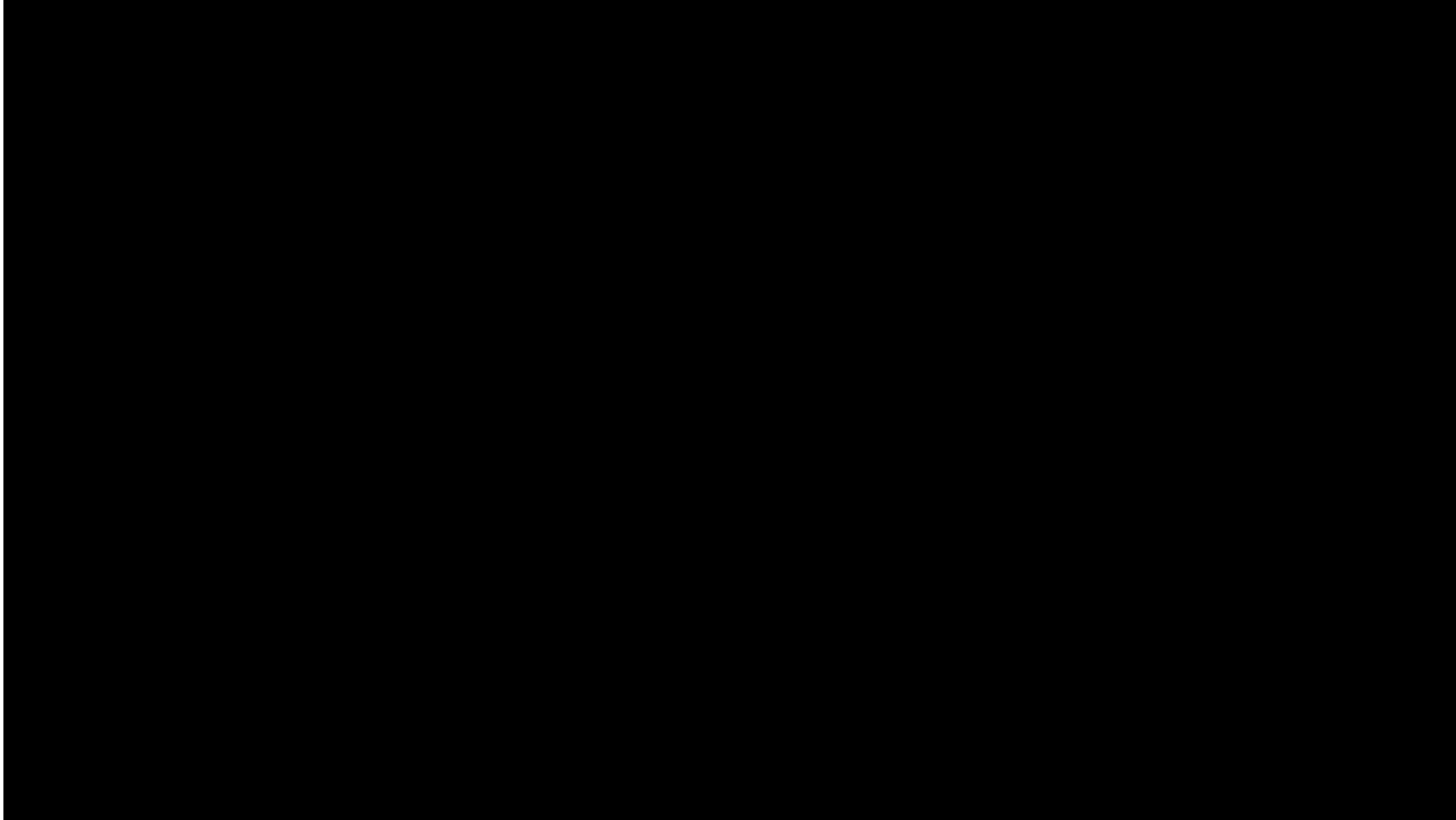


[IEEE Signal Processing Society](#)

<https://www.youtube.com/watch?v=mexN6d8QF9o>



ML and Robotics?



Shkurti, Florian, et al. "Underwater multi-robot convoying using visual tracking by detection." *Intelligent Robots and Systems (IROS)*, 2017
IEEE/RSJ International Conference on. IEEE, 2017.

<https://www.youtube.com/watch?v=Em7V-vBApHc>



ML and Manufacturing (IoT)?



ML and Power Systems?

- ✓ Load/Demand Forecasting
- ✓ Fault Detection and Classification
- ✓ Weather/ Wind Forecasting

