

Digital Transformation & AI Systems

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Copyright 2021 Carnegie Mellon University.

This material is based upon work funded and supported by the Department of Defense under Contract No. FA8702-15-D-0002 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center.

The view, opinions, and/or findings contained in this material are those of the author(s) and should not be construed as an official Government position, policy, or decision, unless designated by other documentation.

References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by Carnegie Mellon University or its Software Engineering Institute.

NO WARRANTY. THIS CARNEGIE MELLON UNIVERSITY AND SOFTWARE ENGINEERING INSTITUTE MATERIAL IS FURNISHED ON AN "AS-IS" BASIS. CARNEGIE MELLON UNIVERSITY MAKES NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, AS TO ANY MATTER INCLUDING, BUT NOT LIMITED TO, WARRANTY OF FITNESS FOR PURPOSE OR MERCHANTABILITY, EXCLUSIVITY, OR RESULTS OBTAINED FROM USE OF THE MATERIAL. CARNEGIE MELLON UNIVERSITY DOES NOT MAKE ANY WARRANTY OF ANY KIND WITH RESPECT TO FREEDOM FROM PATENT, TRADEMARK, OR COPYRIGHT INFRINGEMENT.

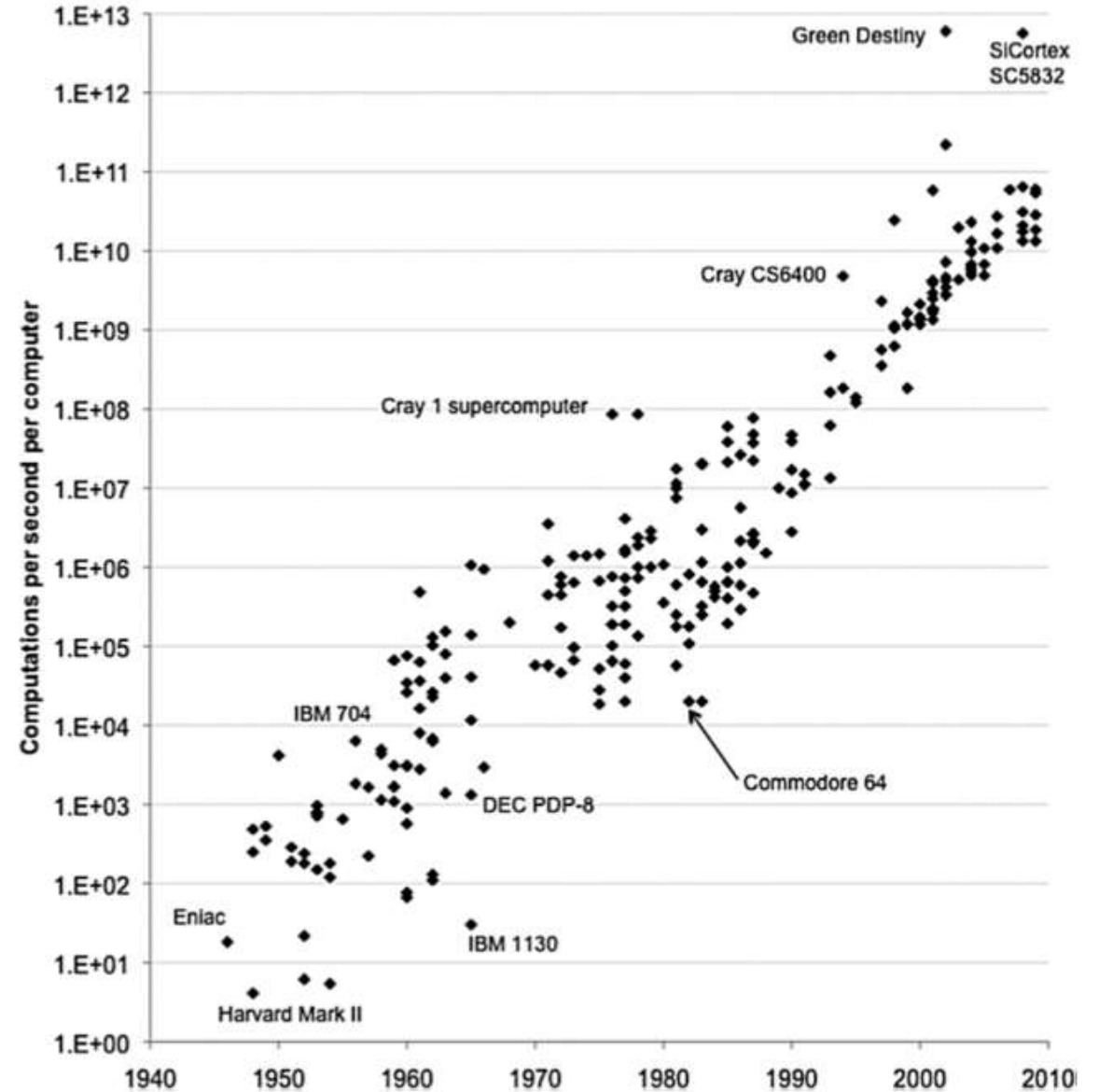
[DISTRIBUTION STATEMENT A] This material has been approved for public release and unlimited distribution. Please see Copyright notice for non-US Government use and distribution.

This material may be reproduced in its entirety, without modification, and freely distributed in written or electronic form without requesting formal permission. Permission is required for any other use. Requests for permission should be directed to the Software Engineering Institute at permission@sei.cmu.edu.

DM21-0673

Setting the Stage

Basic building blocks of technology have been evolving at an exponential rate for some time.



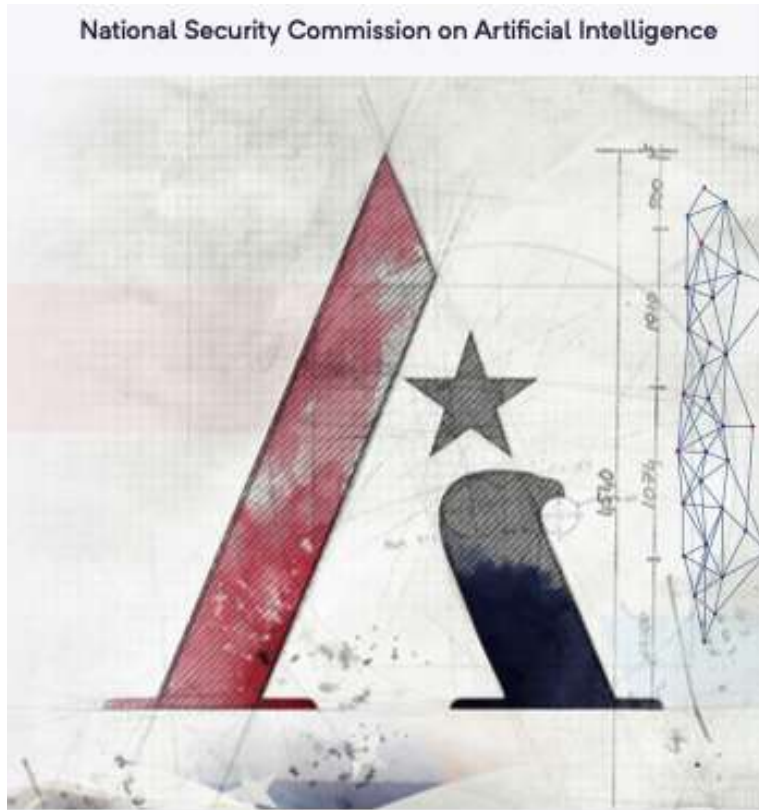


Today, those basic physical, digital, and biological technologies are intersecting to create even more change.

Which is driving large scale systems transformations in many industries.



What kind of world do you want to design?



March 1, 2021

“This new era of competition promises to change the world we live in and how we live within it. We can either shape the change to come or be swept along by it.”



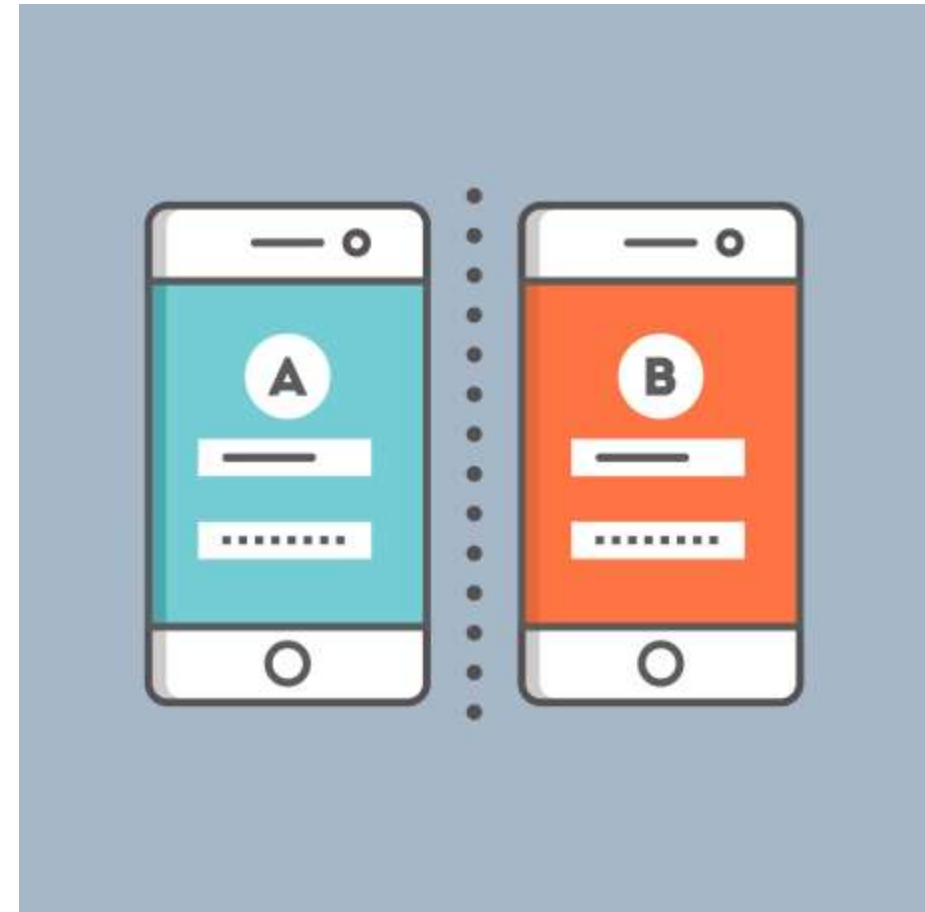
Digital transformation is the adoption of digital processes and tools to achieve stakeholder-driven outcomes.

..and that requires us to deeply understand stakeholder and user experiences.



Much of design research has focused on **use** needs:

What are people doing and how can technology help them do it in a better way?





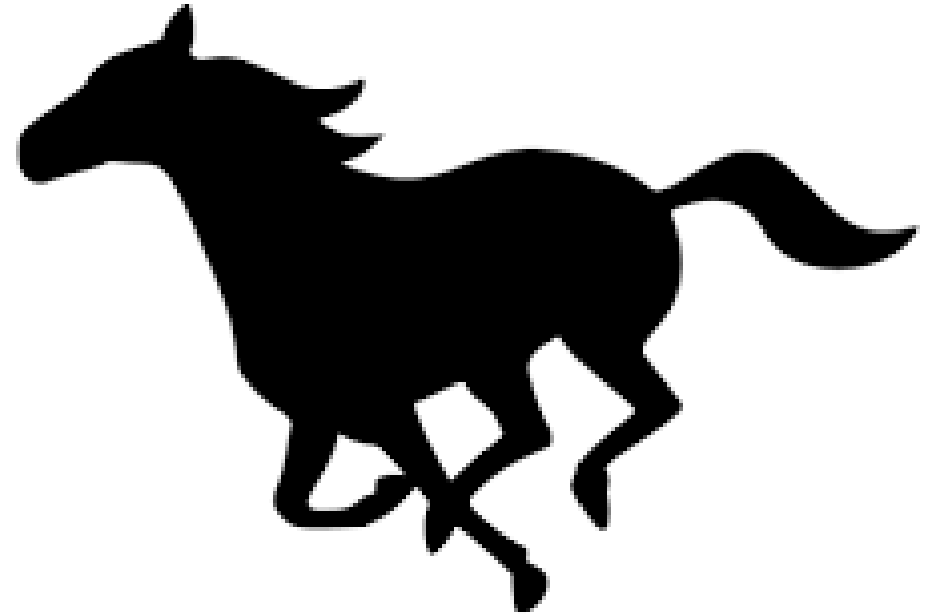
Despite how much data we have today, surfacing desired outcomes remains a major challenge.

Developing Human-Centered AI

One of the most powerful influences on an ML system is how the team defines the objective function or system purpose.



“If I had asked people what they wanted, they would’ve said faster horses.”



When we use a tool, product, or service, we essentially “hire” it to help us do a job.*

The “job” is shorthand for what an individual really seeks to **accomplish** in a given **circumstance**.



When we use a tool, product, or service, we essentially “hire” it to help us do a job.*

The “job” is shorthand for what an individual really seeks to **accomplish** in a given **circumstance**.



What are the users' functional, social, and emotional jobs to be done?



What are the users' functional, social, and emotional jobs to be done?



I want to
get to
work
safely.

What are the users' functional, social, and emotional jobs to be done?



I want to feel better about my environmental impact.

I want to my friends to know I care about the latest technology.

I want to get to work safely.

I want to feel cool.

It is about simple awareness — awareness of what is so real and essential, so **hidden in plain sight** all around us, that we have to keep reminding ourselves, over and over: “This is water, this is water.”



Ways to Understand Stakeholder and User Experience

Participant observation

Non-participant observation

Informant diaries

Intercepts

Formal ethnographic interviews





Ethnographic interviews are different...

An extended open-ended conversation exploring needs, emotions, and aspirations

The interviewee does 90% of the talking

The interview is more than data gathering. You must be ready to hear something new and be changed by it.

At the heart of innovation is the ability to frame and reframe the problem to be solved.



Our challenge areas:

How might we support officers and teams who work with data to better source, share, and maintain data and information?

How might we improve the effectiveness of unclassified analytics?

Our challenge areas:

How might we support officers and teams who work with data to better source, share, and maintain data and information?

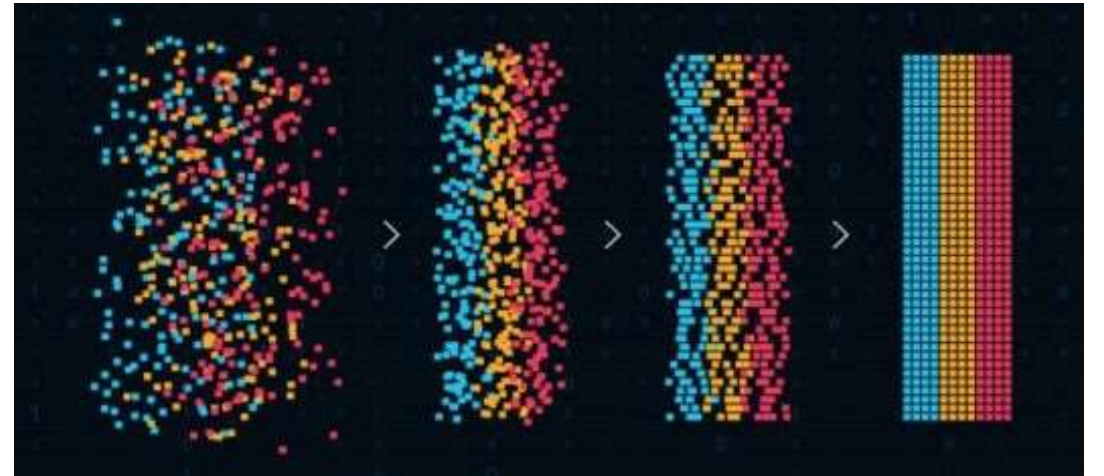
How might we improve the effectiveness of unclassified analytics?

First ask, how can we more deeply understand the problems embedded in the challenge area?

Then, explore how AI/ML systems can be part of the solution.

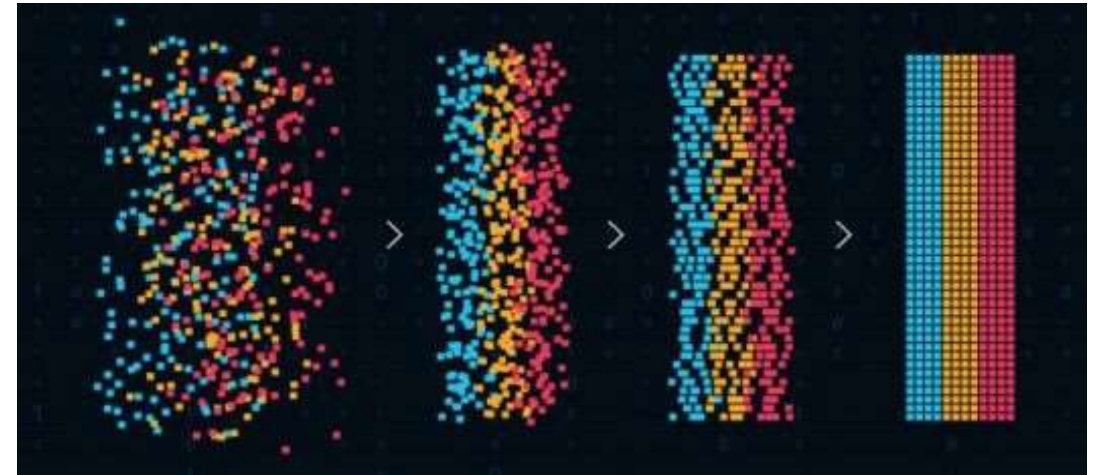
What types of problems can machine learning be used for?

1. Showing users things they could be interested in
2. Understanding what kind of thing it is
3. Predicting a numerical value
4. Putting similar things together
5. Finding uncommon things
6. Finding the right information



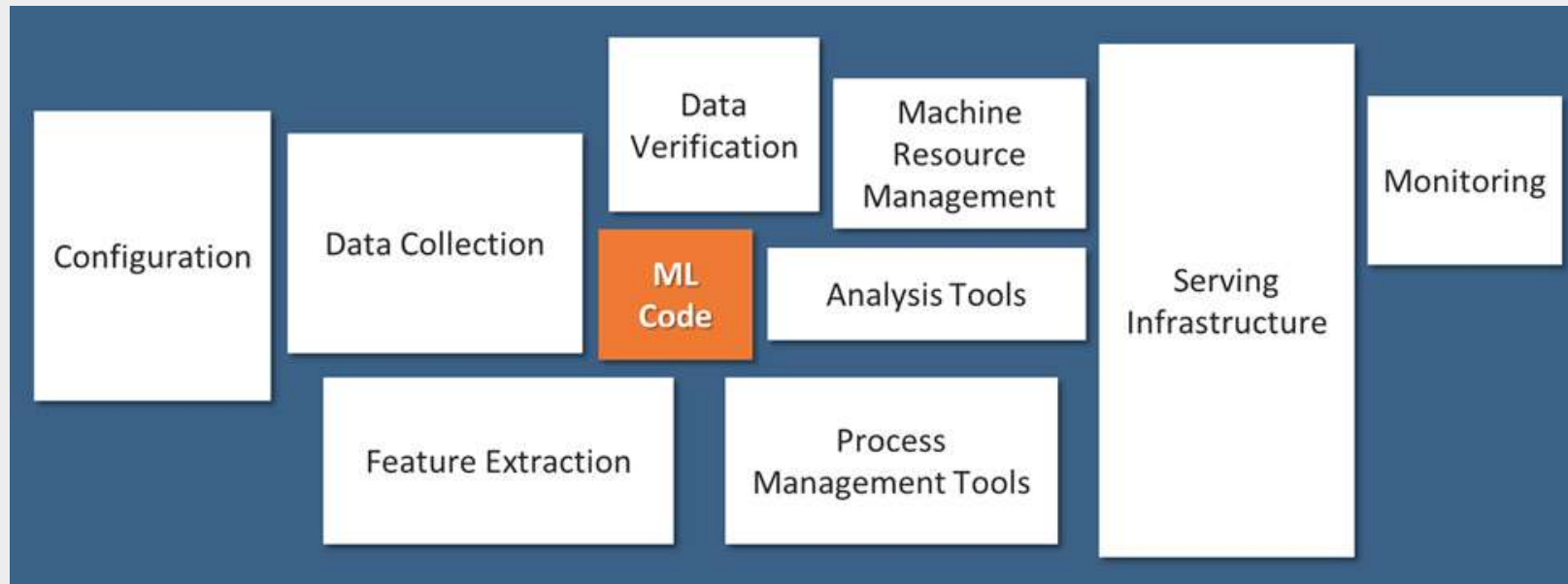
What types of problems can machine learning be used for?


1. Showing users things they could be interested in
2. Understanding what kind of thing it is
3. Predicting a numerical value
4. Putting similar things together
5. Finding uncommon things
6. Finding the right information



...but we have to consider more than the model!

Circumstance & Context





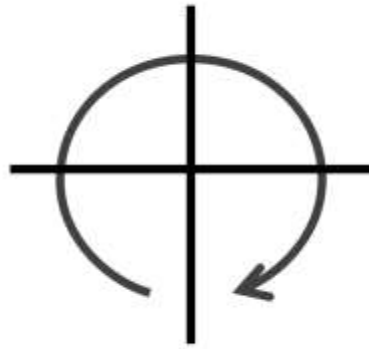
“To manage a system effectively, you might focus on the interactions of the parts rather than their behavior taken separately.”

- Russell Ackoff

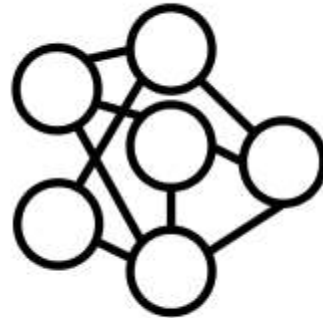
What is needed to guide digital transformation?



Shared
Goal



Problem Framing &
Solving Process



Systems
Mindset



Experimentation



Teaming