

Introduction to Research (in Data Management)

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What is research about?



- ▶ We solve unsolved problems
 - ▶ Unsolved not unsolvable
- ▶ Examples:
 - ▶ How to fly faster?
 - ▶ How to cure cancer?
 - ▶ How to enable a machine to see?
 - ▶ How to understand all data generated by human?
- ▶ Research is about finding solutions for unsolved problems in different life aspects
 - ▶ Health, engineering, behavioral sciences...etc

Is research that big?

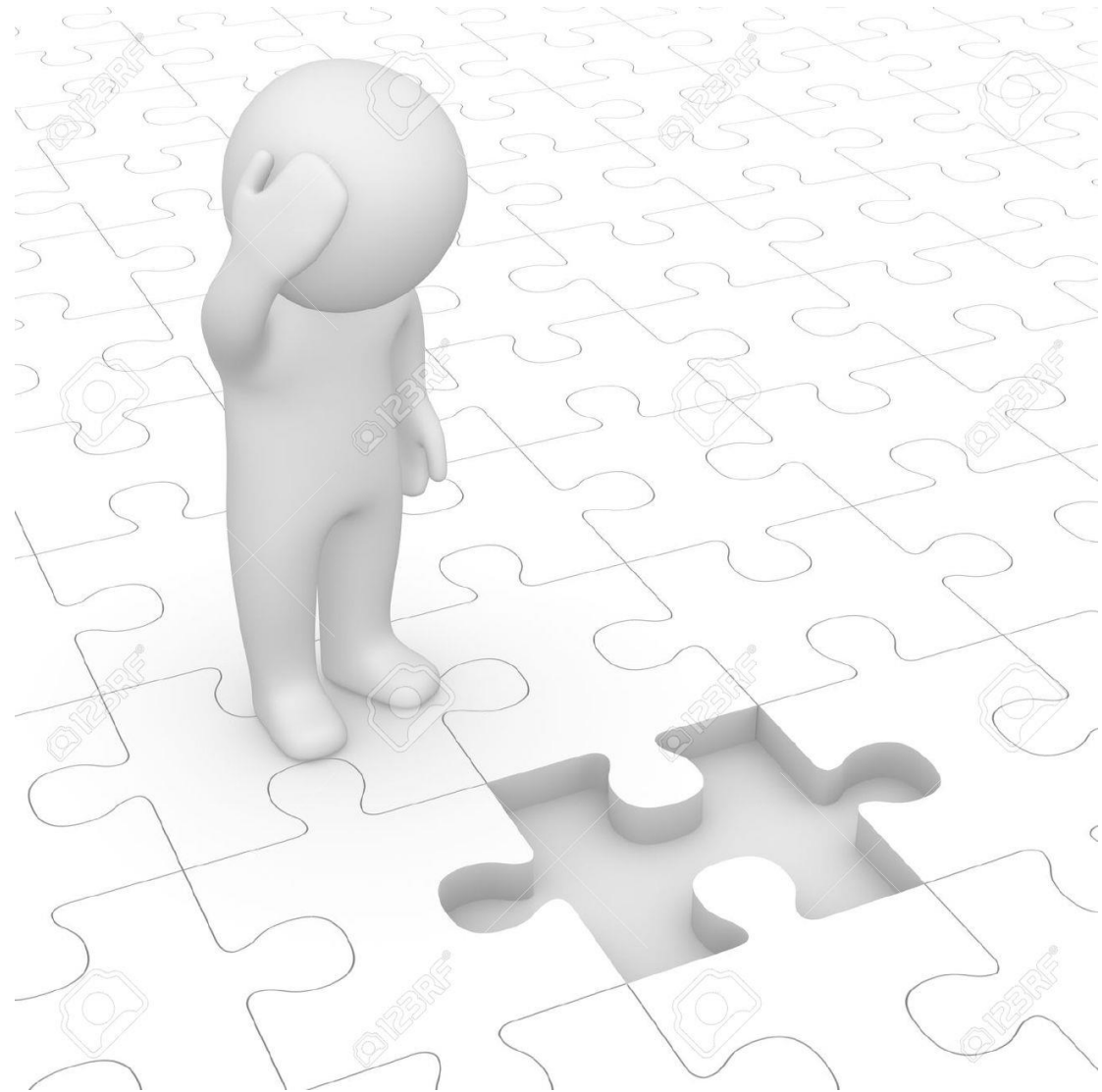


- It is,
 - but many MANY teams contribute to that big problems

- Example: how to enable a machine to see?
 - Subproblems:
 - How a human see?
 - How to make an artificial eye?
 - How to take photos? (Camera) - How to make it better?etc
 - How to make an artificial vision brain?
 - How to segment photos? - How to know objects?etc
 - How to connect eye to brain?
 - How to

Is research that big?

- › It is a big puzzle



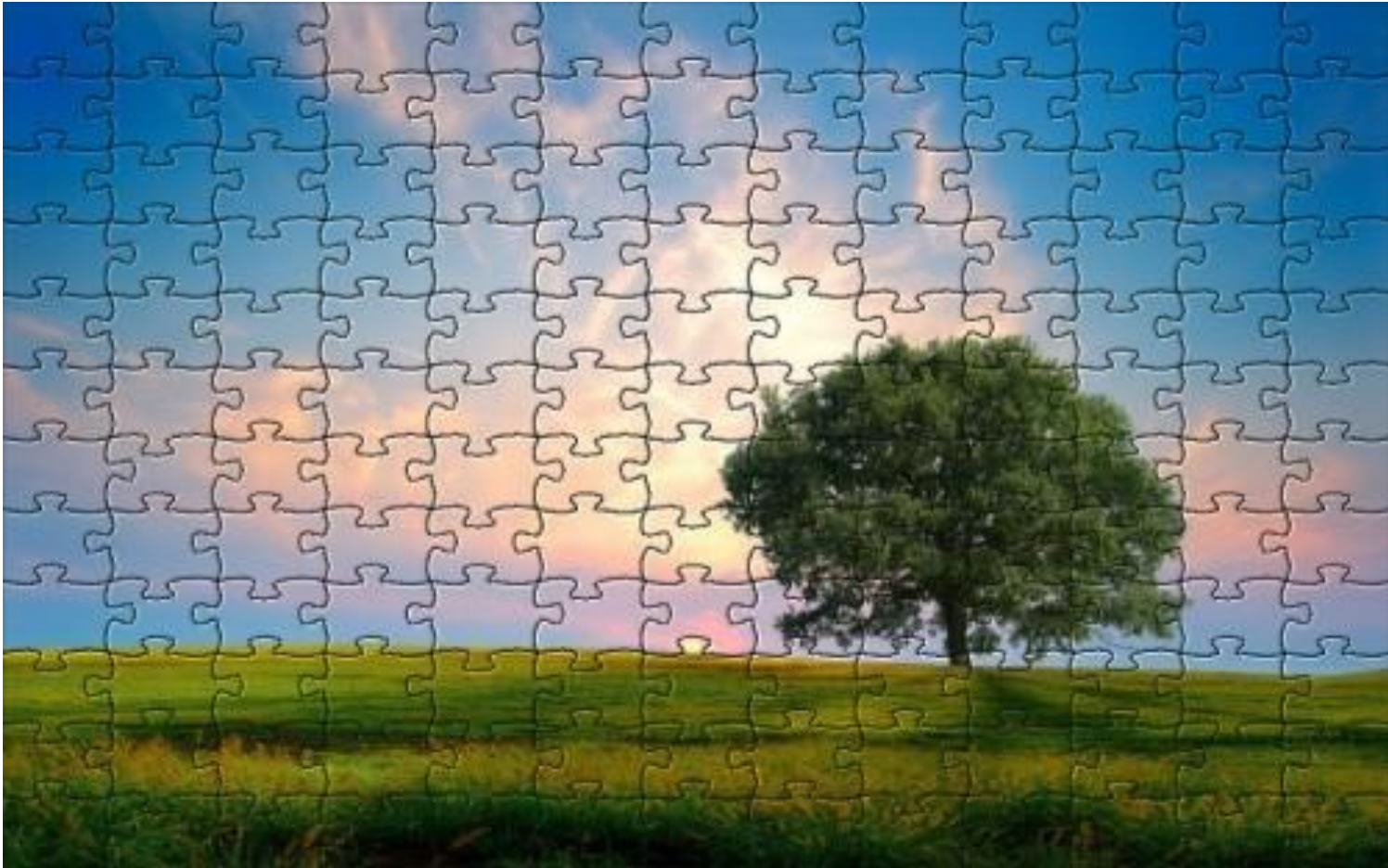
Is research that big?

- › It is a big puzzle



Is research that big?

- › It is a big puzzle



Research problem elements

To address a research problem, answer six questions:

1. What is the problem?
2. Why it is important?
3. Why it is challenging?
4. What are the limitations of the related work?
5. What are the novel contributions?
6. What is the validation method?

Research problem elements

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Research problem elements

To address a research problem, answer six questions:

1. What is the problem?

Computational problem definitions:

- What is the input?
- What is the output?
- What are the objectives/constraints?
- Any other contextual elements for problem definition

Research problem elements



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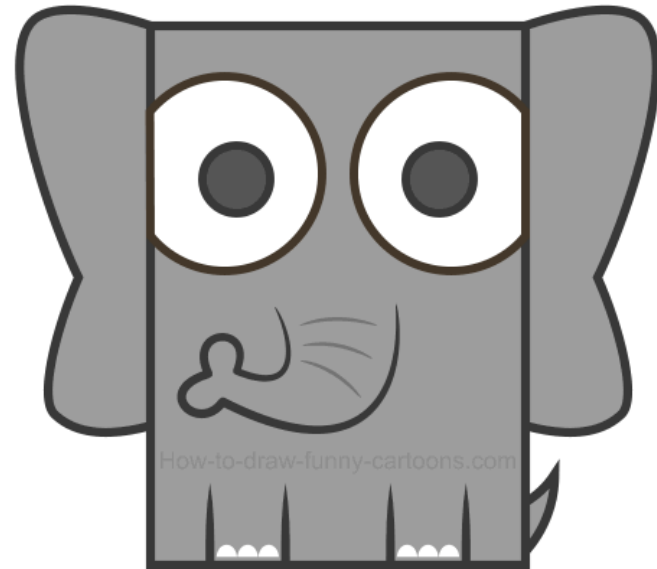
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Research problem elements

To address a research problem, answer six questions:

2. Why is it important?

Getting a square elephant into a circle door is a problem, but not an important one



Research problem elements

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Research problem elements

To address a research problem, answer six questions:

2. Why is it challenging?

calculating $x*y$ is an important problem to solve, but it is not difficult, and it can be handled by hardware in $O(1)$

Research problem elements



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4. **What are the limitations of the related work?**
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Research problem elements



To address a research problem, answer six questions:

4. What are the limitations of the related work?

Given: a point location, 100 millions spatial objects

Find: the nearest neighbor

Important and challenging! but solved before, why existing solutions do not work.

Research problem elements

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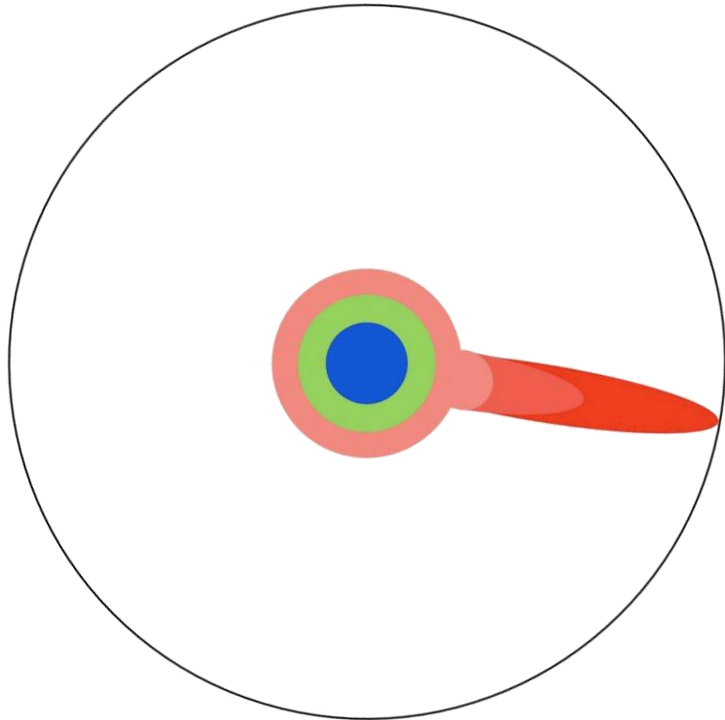
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To address a research problem, answer six questions:

5. What are the novel contributions?

Research is about novel contributions to advance existing knowledge.

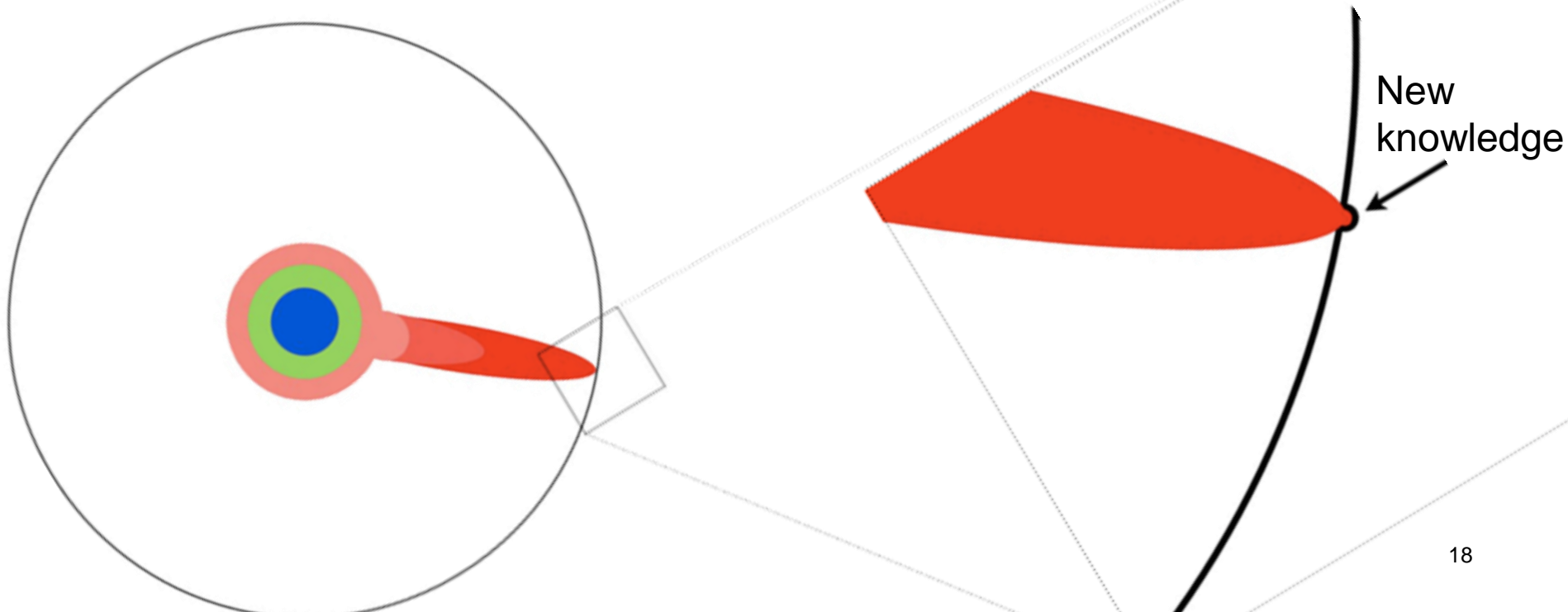


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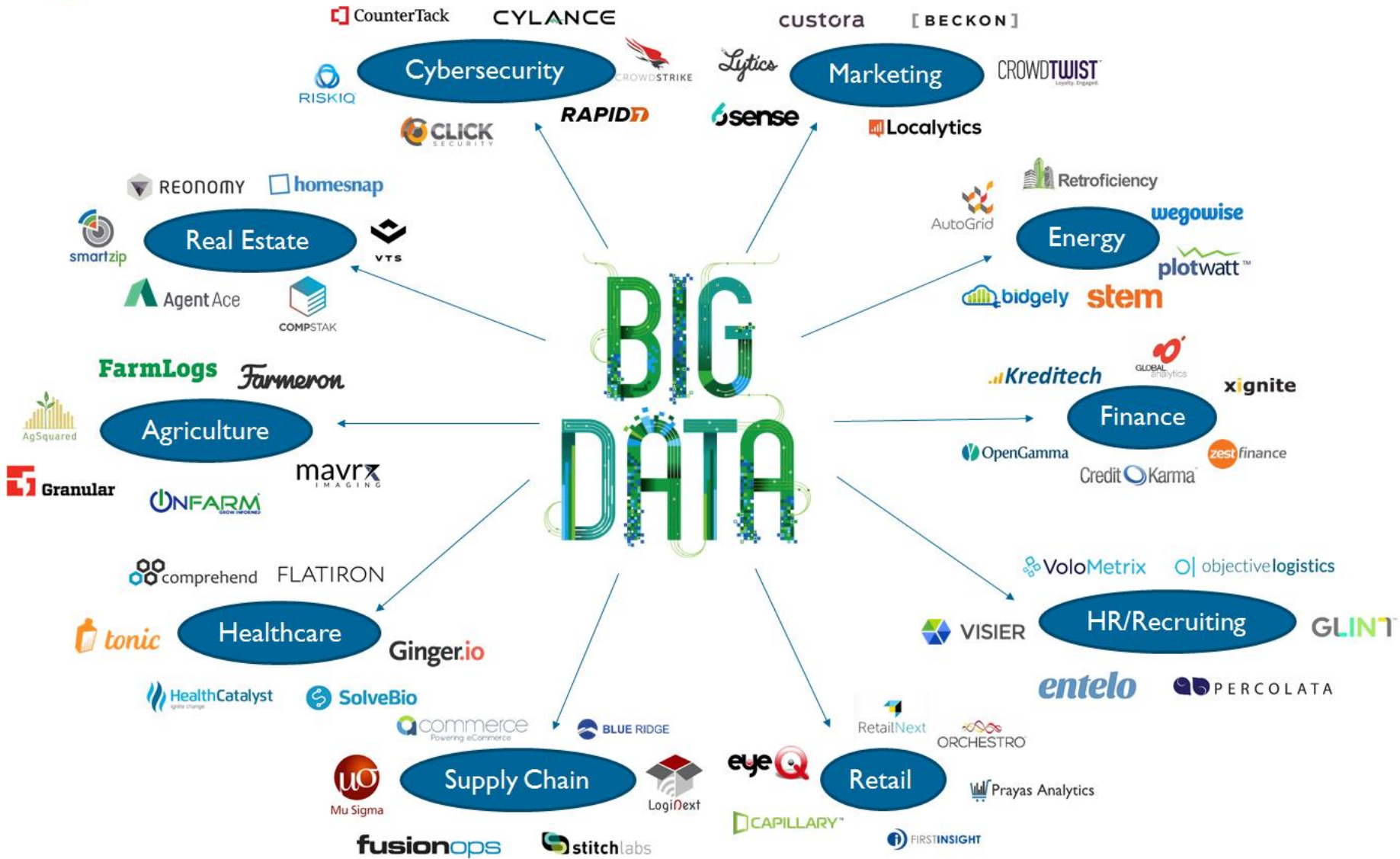
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Introduction to Data Management Research

The digital world

- Data sources:
 - Business: retailers, enterprise, etc
 - Humans: games, social media, crowdsourcing, etc
 - Science: astronomy, biology, satellites, etc
 -
- 199x: Internet services provided to public
- 200x: Internet comes to mobile devices (revolution)
- Now: ?

Startups Using Big Data



Data is the new Oil



**The
Economist**

The world's most valuable resource is no longer oil, but data

The data economy demands a new approach to antitrust rules

BRAINSTORM TECH

FORTUNE

Why Data Is The New Oil

Jonathan Vanian

Jul 11, 2016

Tech

APR 2, 2012 @ 11:09 AM

Forbes

Is Data The New Oil?

Oil Refinery vs. Data Refinery



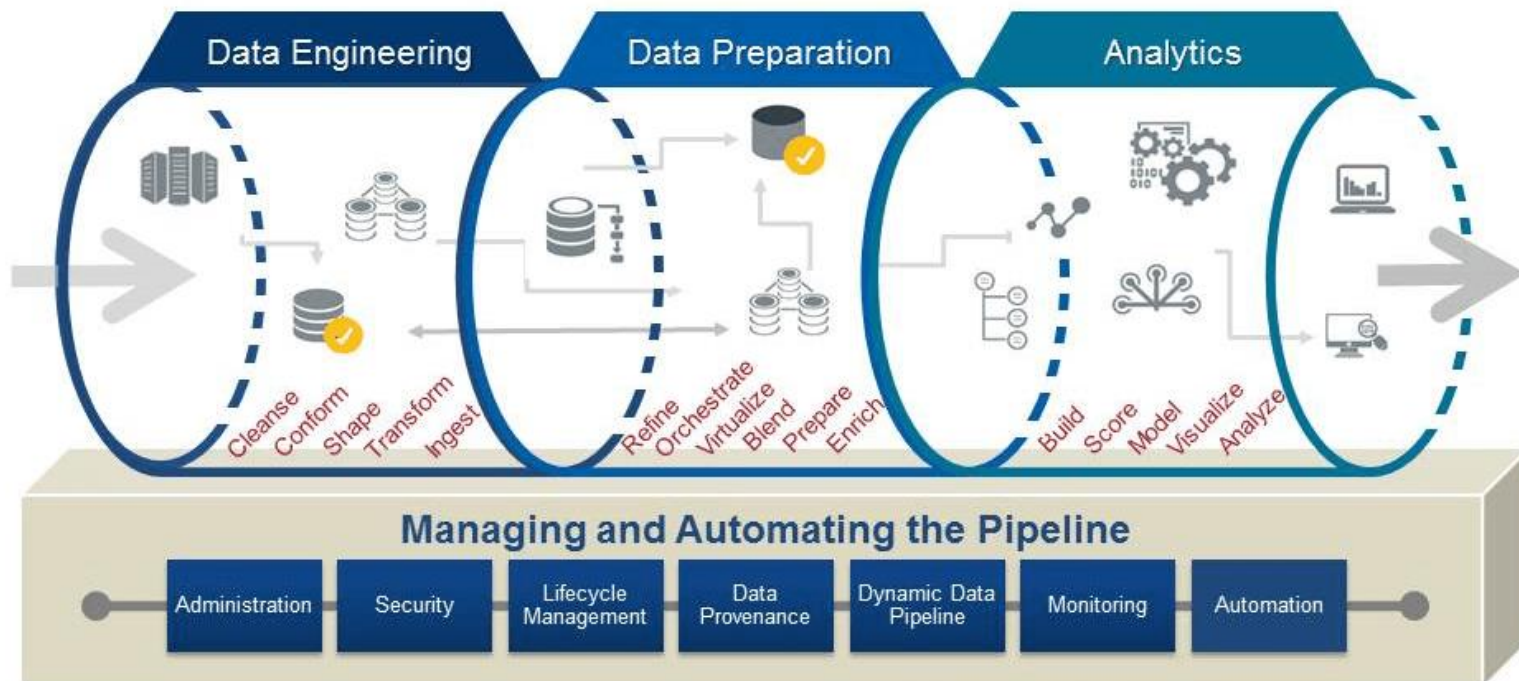
“Data is just like crude. It’s valuable, but if unrefined it cannot really be used.”

Michael Palmer

Oil Refinery vs. Data Refinery

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Oil Refinery vs. Data Refinery



57,110 views | Mar 5, 2018, 12:28am



Here's Why Data Is Not The New Oil



Bernard Marr Contributor
Enterprise & Cloud

WIRED

BUSINESS CULTURE GEAR IDEAS SCIENCE SECURITY TRANSPORTATION

ANTONIO GARCÍA MARTÍNEZ

IDEAS 02.26.2019 07:00 AM

No, Data Is Not the New Oil

Proposals to "pay" users for the value of their data don't reflect how internet giants like Facebook and Google really operate.

Towards
Data Science

DATA SCIENCE

MACHINE LEARNING

PROGRAMMING

VISUALIZATION

AI

JOURNALISM

Data is not the new oil

About the reality of working with data



Samuel Flender [Follow](#)

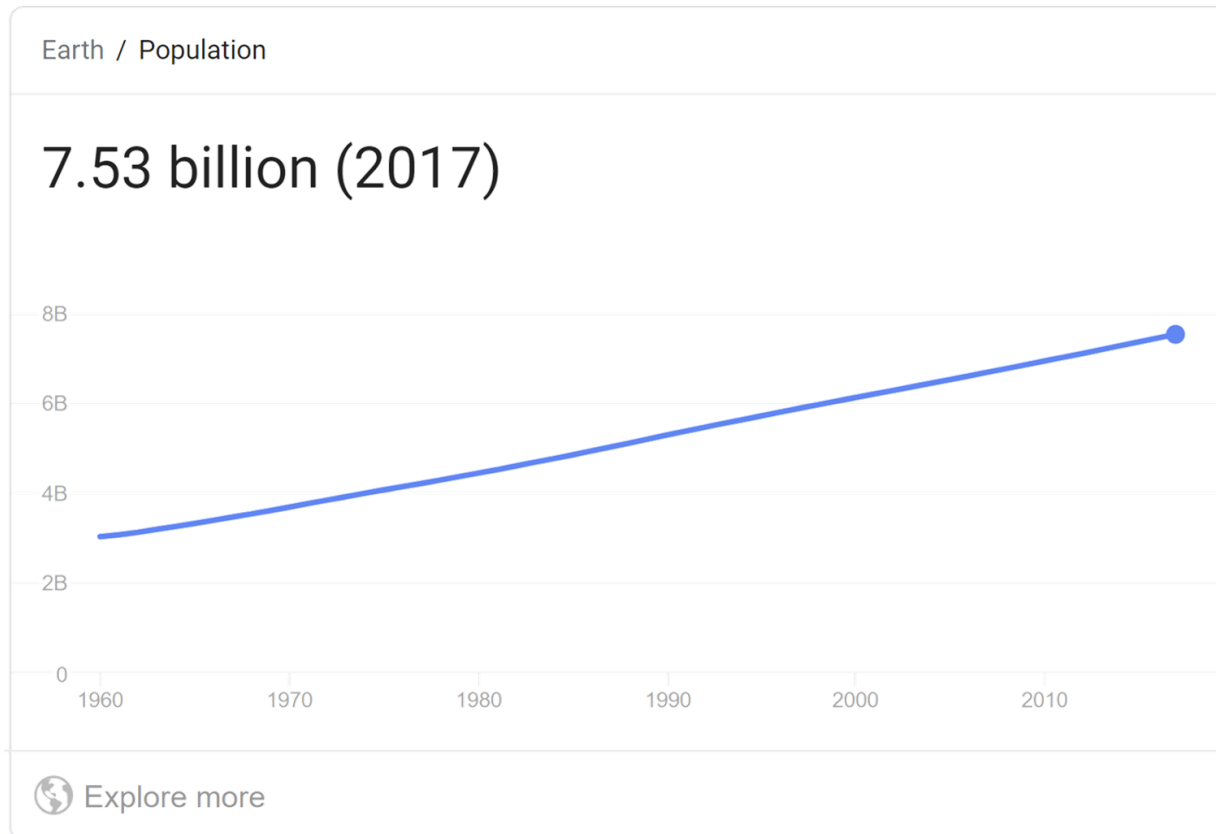
Oil Refinery vs. Data Refinery



- Why data might not be the new oil?
 - Oil refinery is much more deterministic (easier?)
 - Oil is finite, data is not

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Stages and Activities

› Stages:

- › Identifying a problem
- › Proposing a solution
- › Realizing and validating the solution
- › Documenting the research (writing papers)

› Activities:

1. **Reading:** existing work, prior knowledge,...etc
2. **Coding:** your solution, related work, utilities,...etc
3. **Writing:** papers, summaries,...etc
4. **Presenting:** your problem, solution, surveys, etc