Carnegie Mellon University

Data Discovery and Reuse: AI Solutions & the Human Factor

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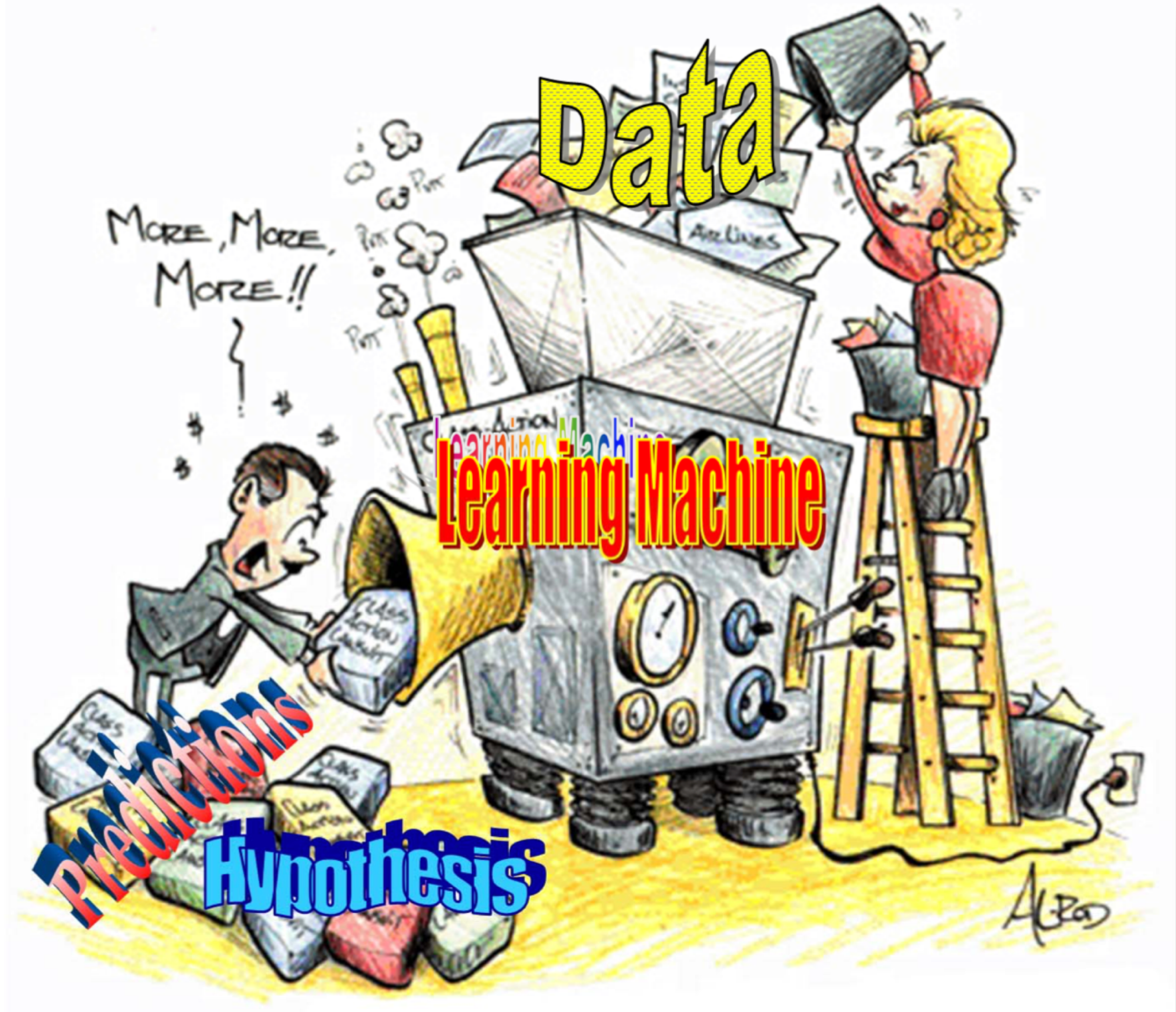
The AI pipeline starts from data

“Garbage in, garbage out”: What does it mean?



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AI is only as good as it’s data

- Poor data quality (accuracy, completeness, bias, consistency, validity, uniqueness, ….)

  → Bias or wrong prediction

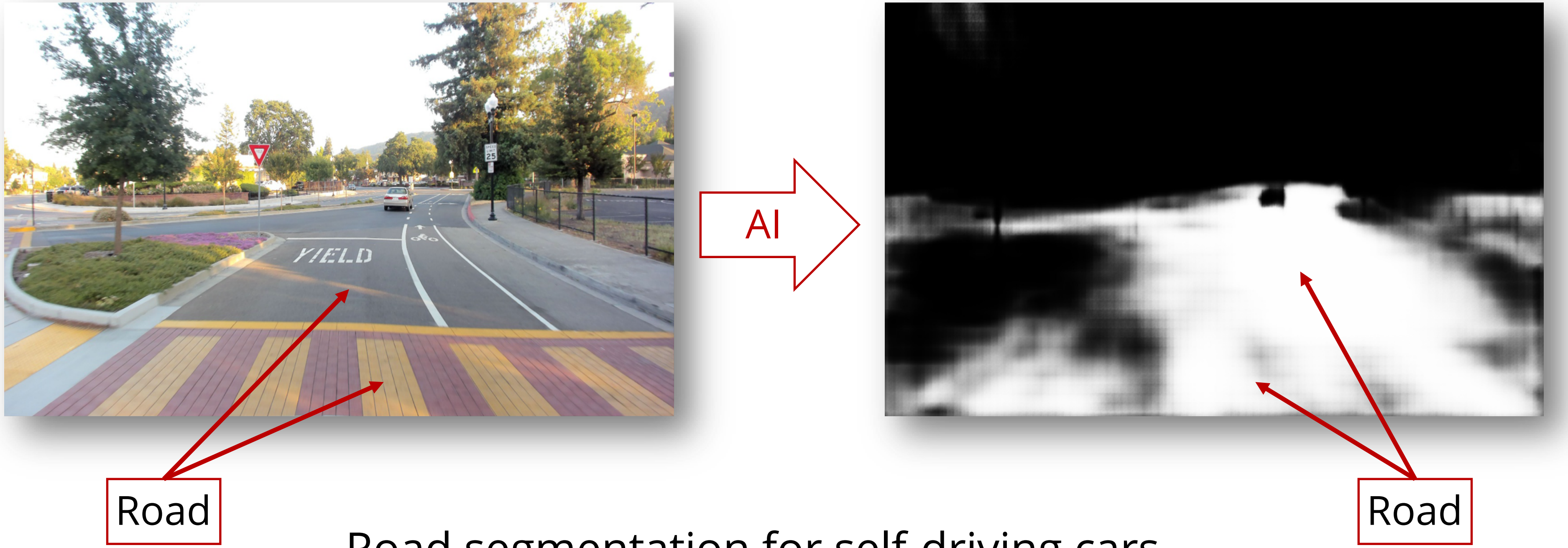
- Poor metadata or documentation

  → Data data (re)usability

- Not enough data

  → Model performance; overfitting

Key to successful AI systems:
accessible high quality labeled data



Road segmentation for self-driving cars

Adapted from Evgeny Toropov. AIDR ’19.

High quality data are hard to find

Lab website / Server

404

Page not found :(

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Google Drive

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DRYAD

HARVARD Dataverse

re3data.org

REGISTRY OF RESEARCH DATA REPOSITORIES

zenodo

PubMed

NIH NATIONAL CANCER INSTITUTE Genomic Data Commons

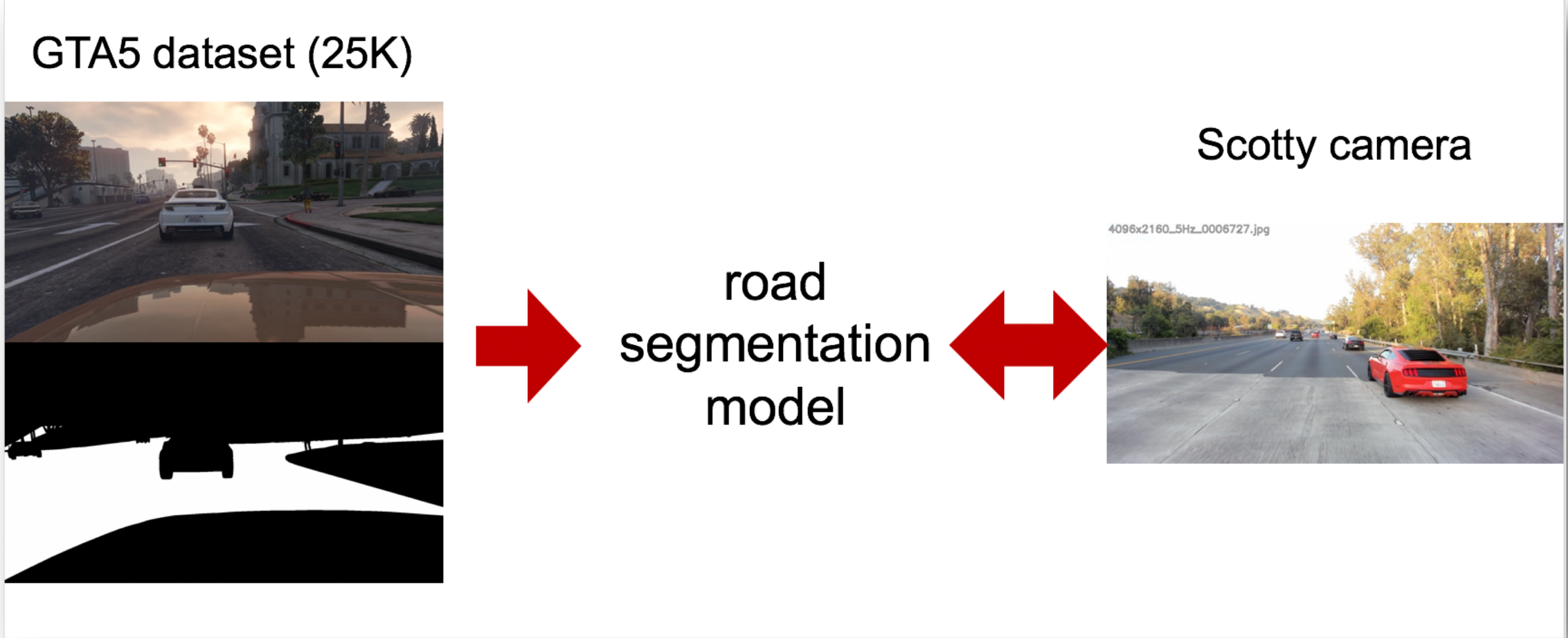
High quality data are hard to find

Technical solutions

- Search engines to find existing data
- Automation in evaluating data quality and integrating datasets
- Automation in data curation
- Model transfer and data augmentation

https://events.library.cmu.edu/aidr2019/

Technical use case 1: Domain adaptation to transfer model to new data



Road segmentation for self-driving cars

Technical use case 2: Finding existing datasets

- Datasets are distributed and hard to find
- Structured data
  - Web (1%*)
  - Repositories
- Unstructured data
  - Web (99%)
  - Publications
  - Images
- Overall discovery layer missing

```
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<title>Grandma's Holiday Apple Pie</title>
<script type="application/ld+json">
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  "image": "http://images.edge-generalmills.com/564592
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    "carbohydrateContent": "43 g",
  },
  "recipeIngredient": [
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    "6 cups thinly sliced, peeled apples (6 medium)",
    "..."
  ],
```

figshare
DRYAD
HARVARD Dataverse
re3data.org REGISTRY OF RESEARCH DATA REPOSITORIES
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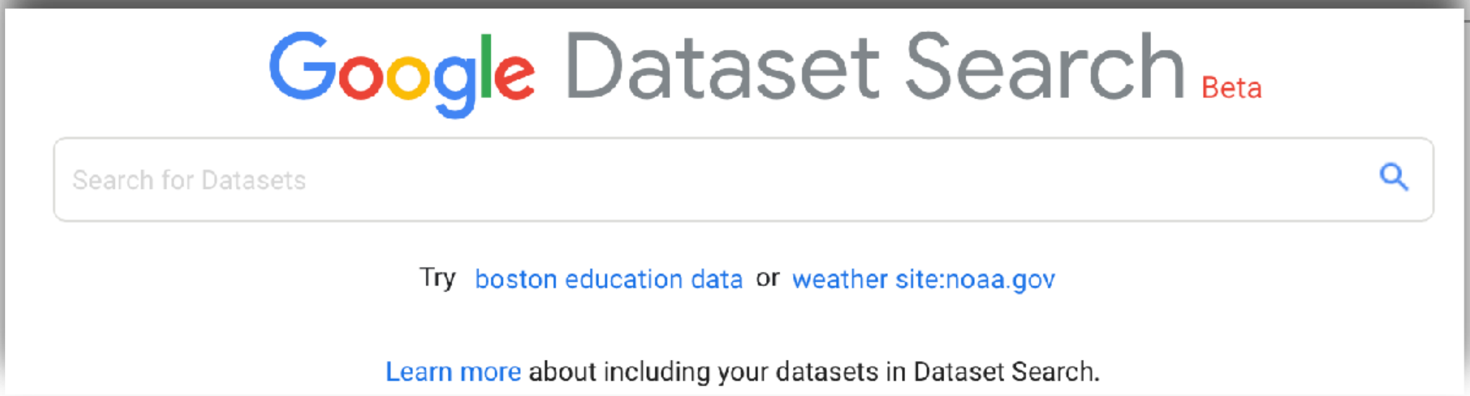
* https://www.bostonwebdesigners.net/news/structured-data-and-local-seo/

Technical use case 2:
Finding existing datasets (structured)

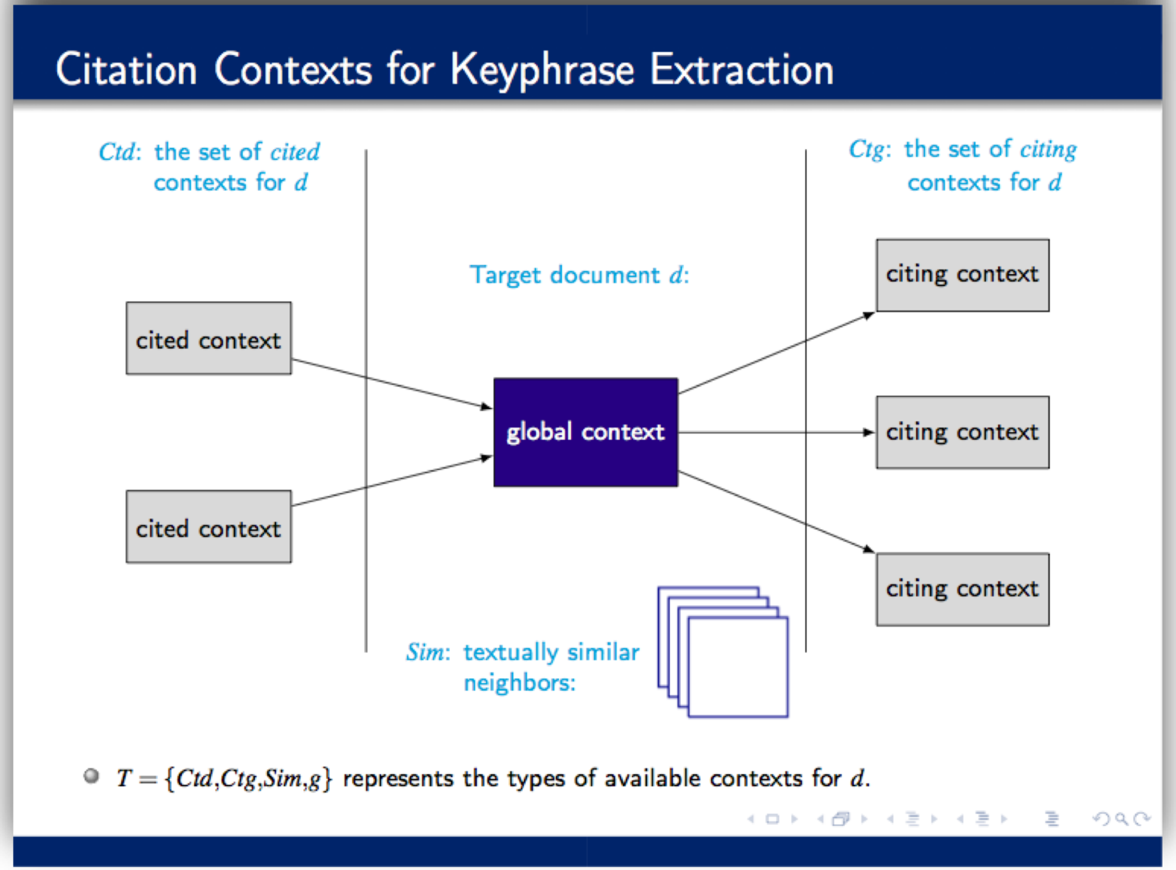


- Search engine powered by AI
- Simple keyword search for datasets across the web
- Searches over embedded **metadata**
  - Searches over metadata from data providers
  - schema.org data standards (embedded in html)
  - Dataset name, description, provider, temporal coverage, …

Technical use case 2:
Finding existing datasets (unstructured)

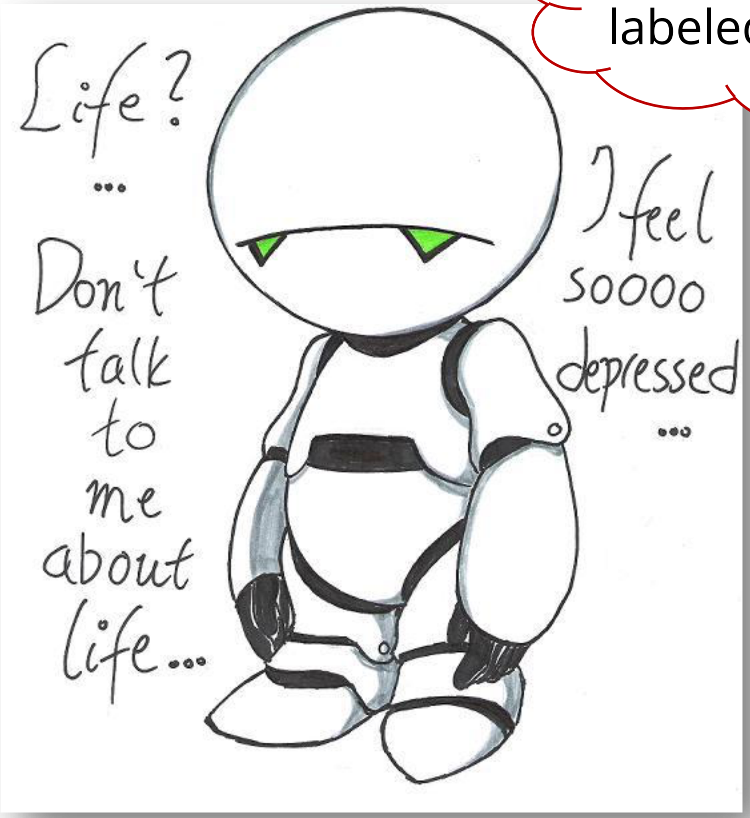
Unstructured data: need metadata tagging and data linking first

- Keyphrase extraction from scholarly documents



 Cornelia Caragea and C. Lee Giles. AIDR '19.

Why aren’t the
data already
labeled? …



 https://www.deviantart.com/stantti/art/MARVIN-35569632

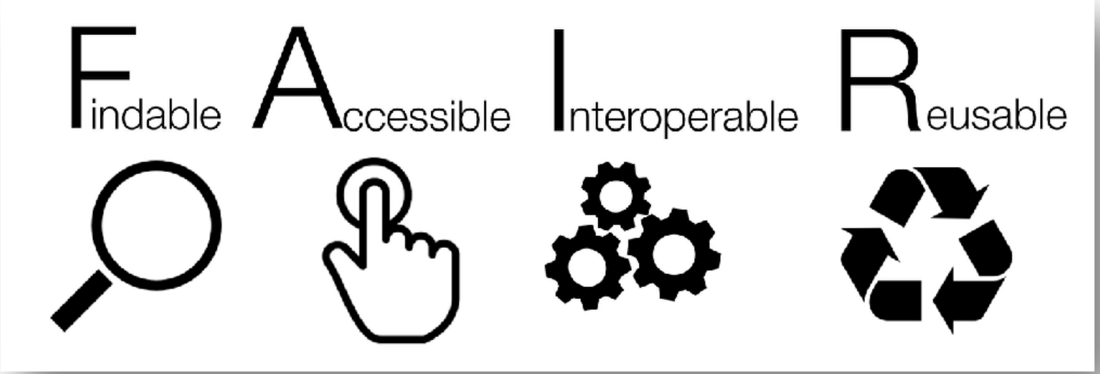
Non-technical solutions (the human factor)

Data stewardship

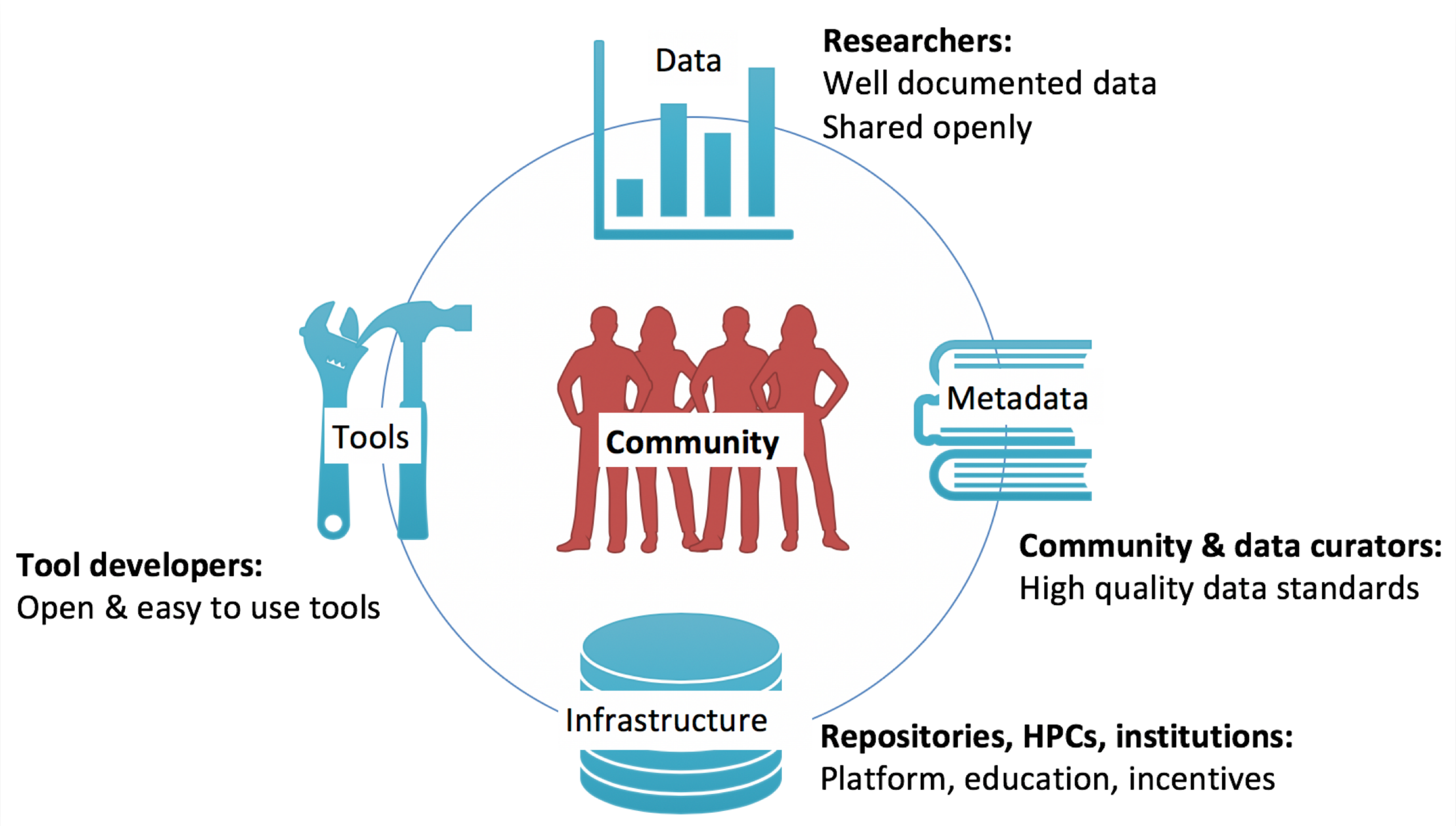
- Responsible data collection and documentation
- Data management best practices
- Metadata & **data standards**

Open science and data sharing

- Share data, code, workflow
- Follow FAIR principles
- Build easy to use and robust tools for data sharing and reuse
- Interdisciplinary collaborations

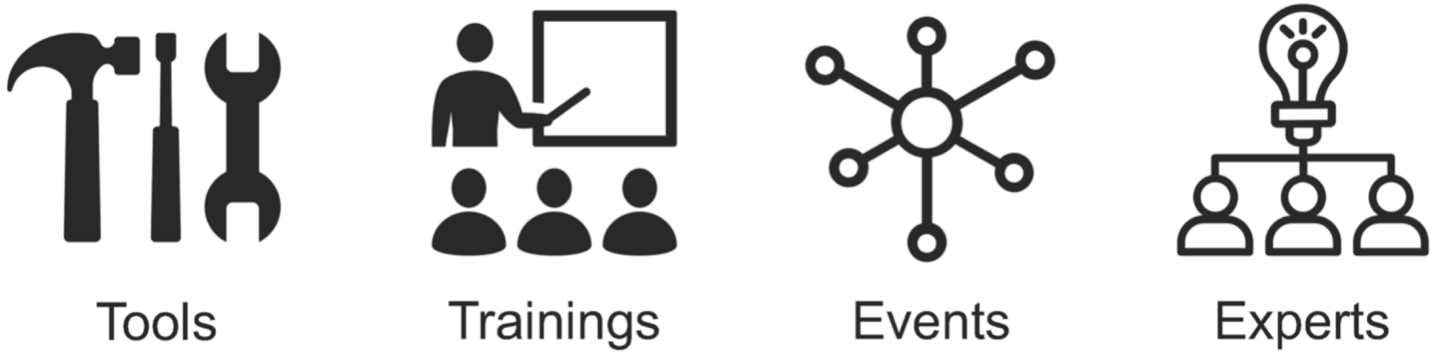


Work together to build a healthy data ecosystem



Open Science & Data Collaborations Program @Carnegie Mellon

Support open practices across the entire research life cycle – from project planning, DMPs, preregistration, through operational data management and documenting reproducible workflows and methods, to publicly sharing research products including data and code in a way that is discoverable and reusable (FAIR+).



 https://events.library.cmu.edu/aidr2020/

Thank you!

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Photo: "Mobot" (MObile roBOTs) competition at CMU's spring carnival.