ZOOOM

OPEN SOURCE AI

ENABLEMENT, TRANSPARENCY AND REPRODUCIBILITY

Jutta Suksi, VTT Technical Research Centre of Finland Ltd
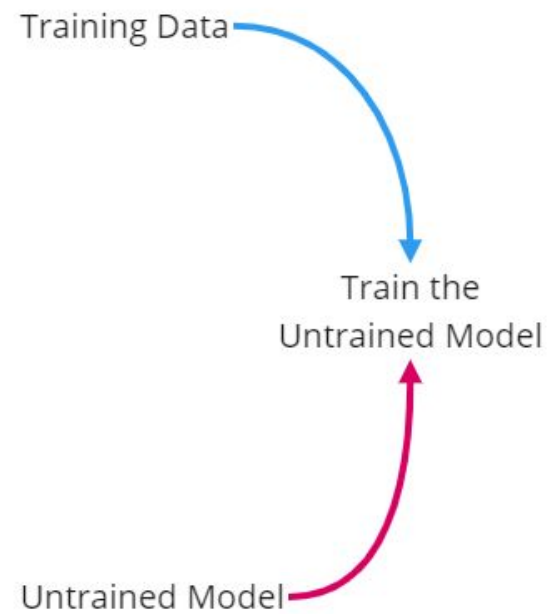Ivo Emanuilov, KU Leuven Centre for IT & IP Law

OUTLINE FOR THE PRESENTATION

- **Phases of building AI**
- **Components of building AI**
- **Deep dive** **to copyright and training data**
- **Layers in AI**
- **Deep dive** **to AI as hybrid IP**
- **Building open source AI**
- **Deep dive** **to open source AI definition**
- **Evolution of the AI license scene**
- **Learnings from the AI license scene**
- **Adoption of AI licenses**
- **Regulatory requirements and impact**
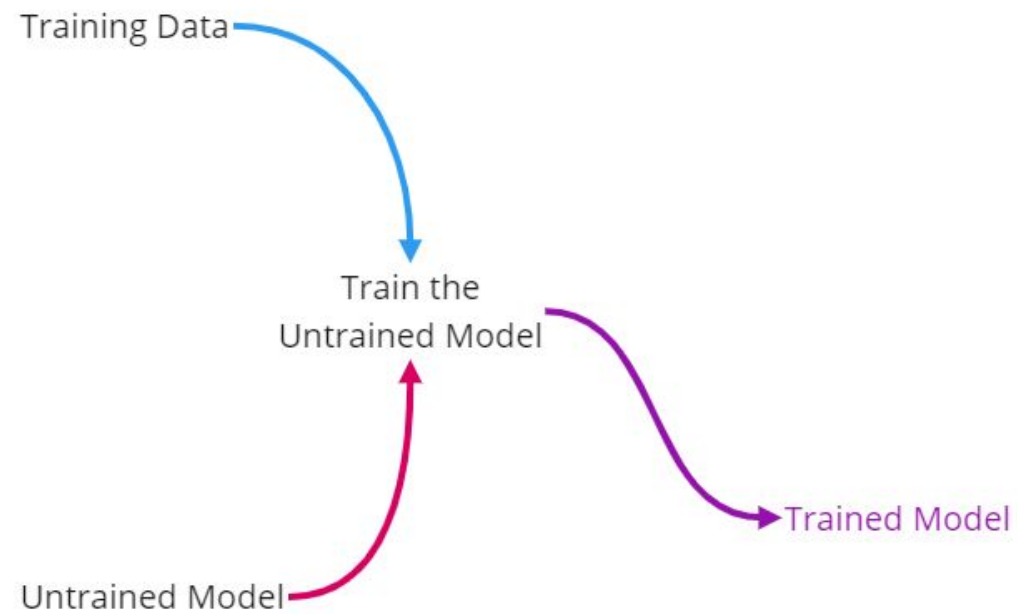- **Learning to understand hybrid technologies**

ZOOOM

PHASES OF BUILDING AI

PHASES OF BUILDING AI

Phases of building AI

Training Data

Train the
Untrained Model

Untrained Model

Trained Model

PHASES OF BUILDING AI

Training Data → Train the Untrained Model

Untrained Model → Train the Untrained Model

Train the Untrained Model → Trained Model

Trained Model → Apply the Trained Model to Data

Input Data → Apply the Trained Model to Data

PHASES OF BUILDING AI

Training Data → Train the Untrained Model
Untrained Model → Train the Untrained Model
Train the Untrained Model → Trained Model → Apply the Trained Model to Data
Input Data → Apply the Trained Model to Data → Output
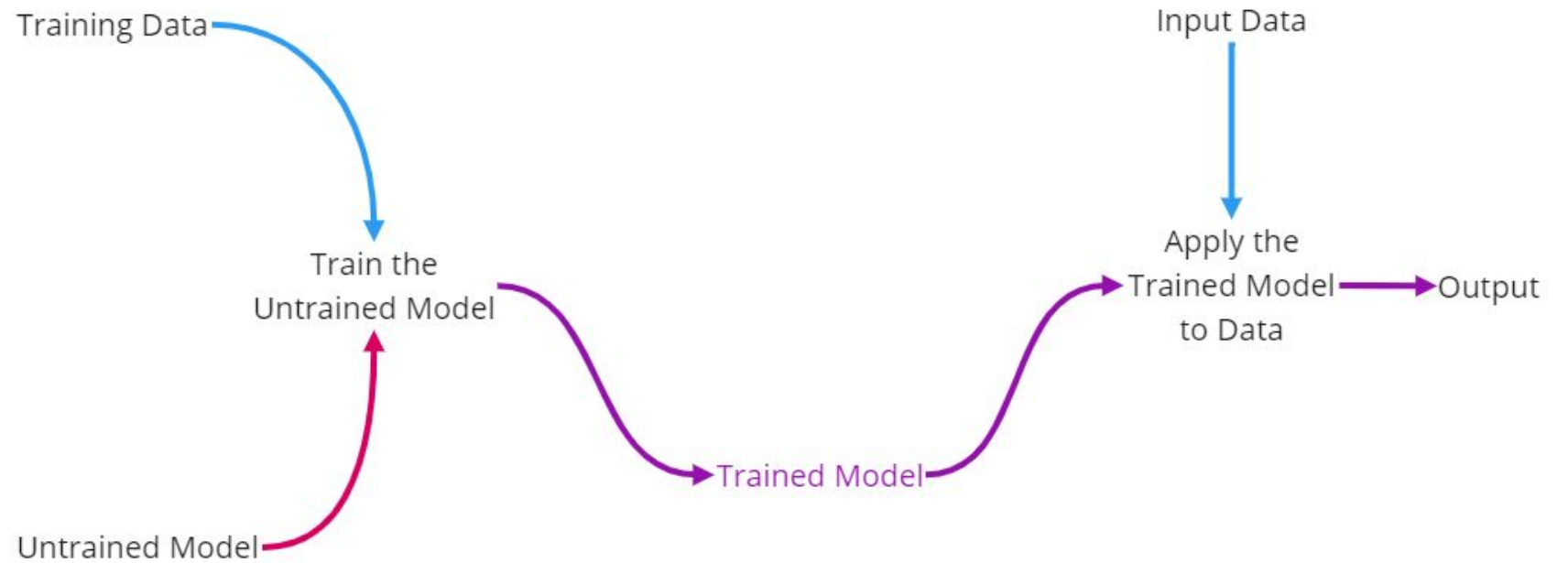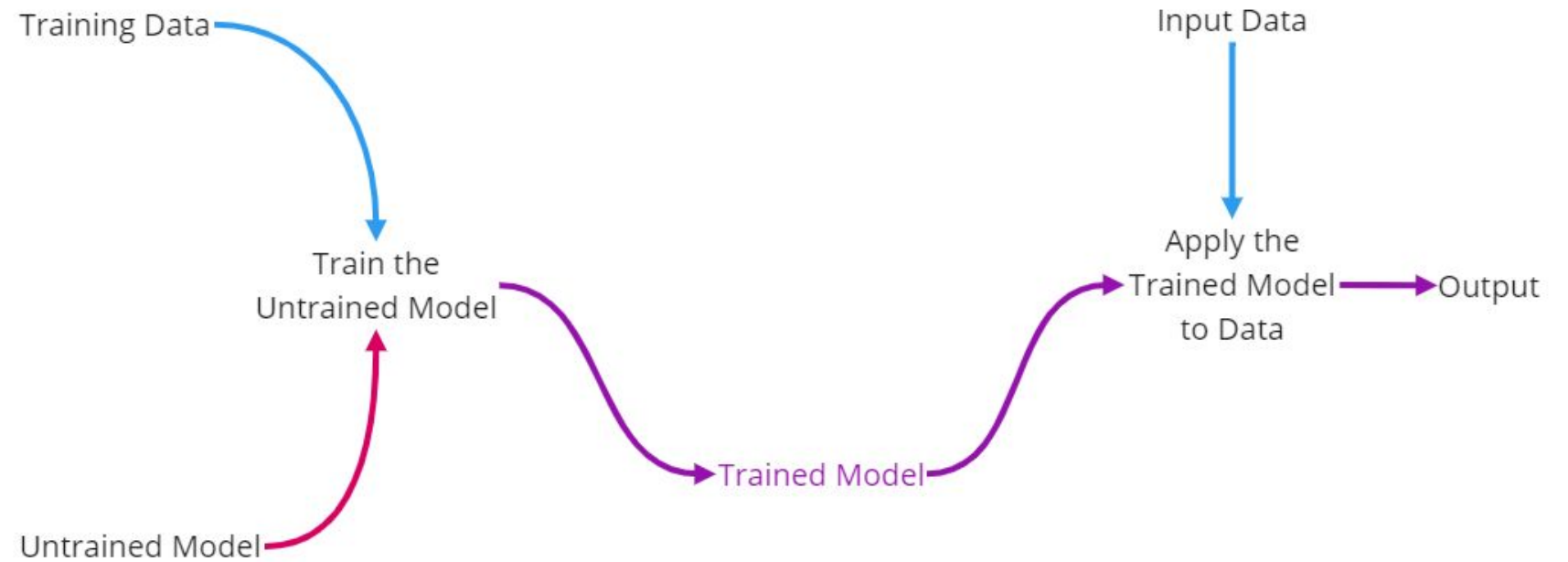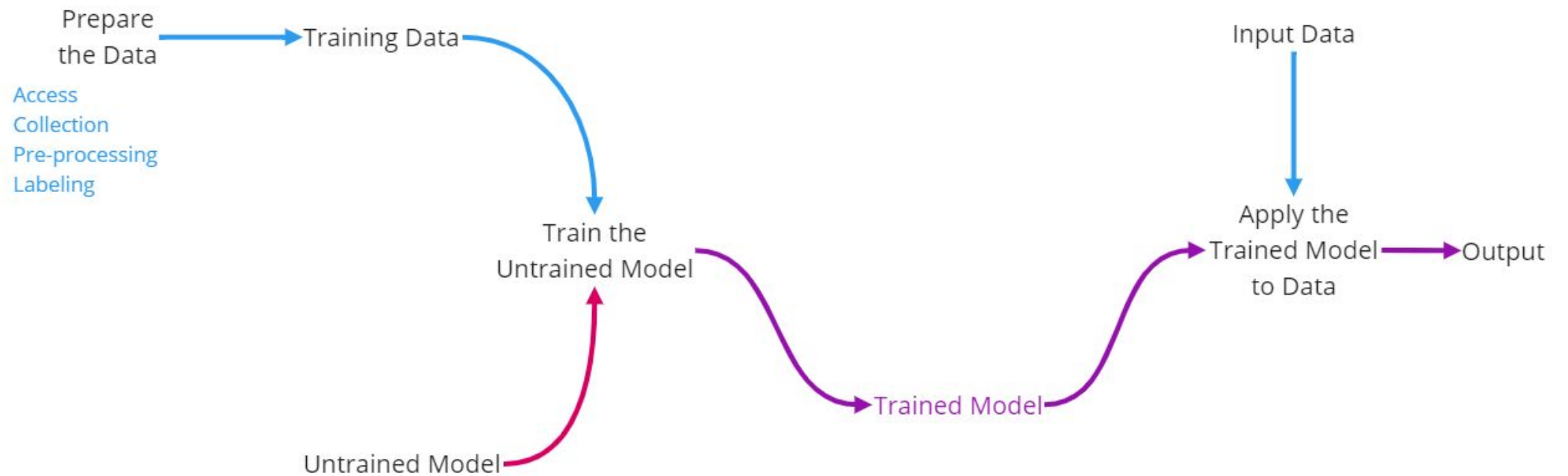
COMPONENTS OF BUILDING AI

Let's dig a bit deeper!

COMPONENTS OF BUILDING AI

Training Data → Train the Untrained Model

Untrained Model → Train the Untrained Model

Train the Untrained Model → Trained Model

Trained Model → Apply the Trained Model to Data

Input Data → Apply the Trained Model to Data

Apply the Trained Model to Data → Output

COMPONENTS OF BUILDING AI

Prepare the Data → Training Data

Access
Collection
Pre-processing
Labeling

Train the Untrained Model

Untrained Model

Trained Model

Input Data → Apply the Trained Model to Data → Output

Components of building AI

Prepare the Data
Access
Collection
Pre-processing
Labeling

Training Data

Train the Untrained Model

Building the components
Building the structure
Optimizing

Build the Untrained Model

Untrained Model

Trained Model

Input Data

Apply the Trained Model to Data

Output

COMPONENTS OF BUILDING AI

Prepare the Data → Training Data

Access
Collection
Pre-processing
Labeling
Predefined models

Knowledge representation

Building the components
Building the structure
Optimizing

Build the Untrained Model → Untrained Model

Train the Untrained Model → Trained Model

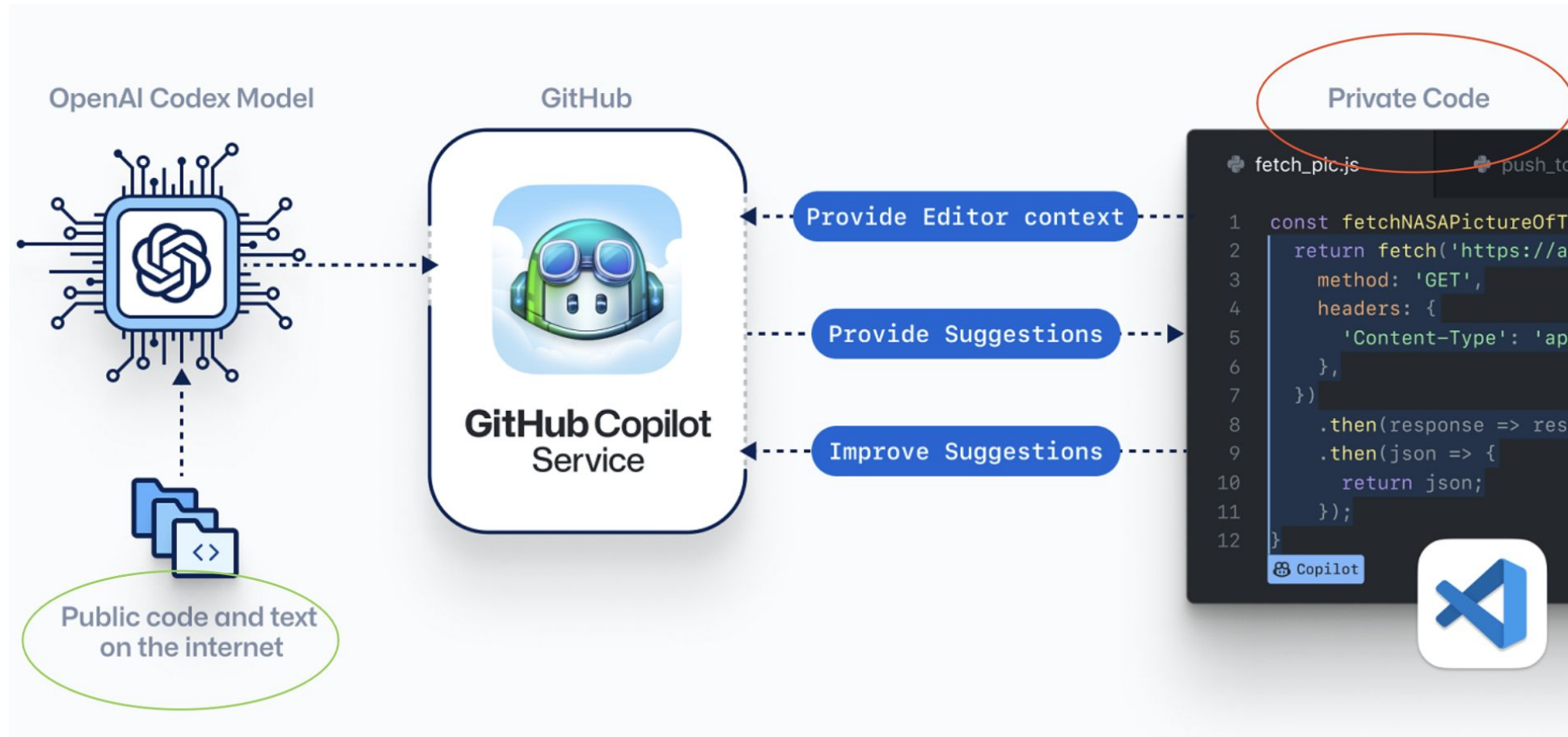Input Data → Apply the Trained Model to Data → Output

Components of building AI

COMPONENTS OF BUILDING AI
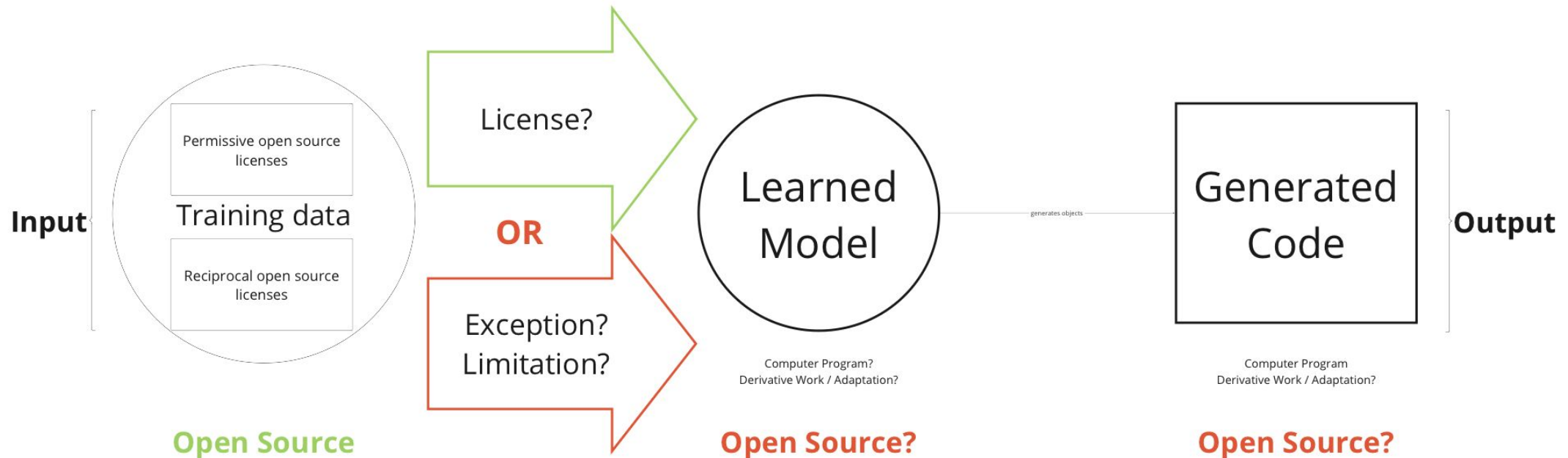
Deep dive into copyright and training data

FROM CODE TO DATA TO CODE...

Article 4

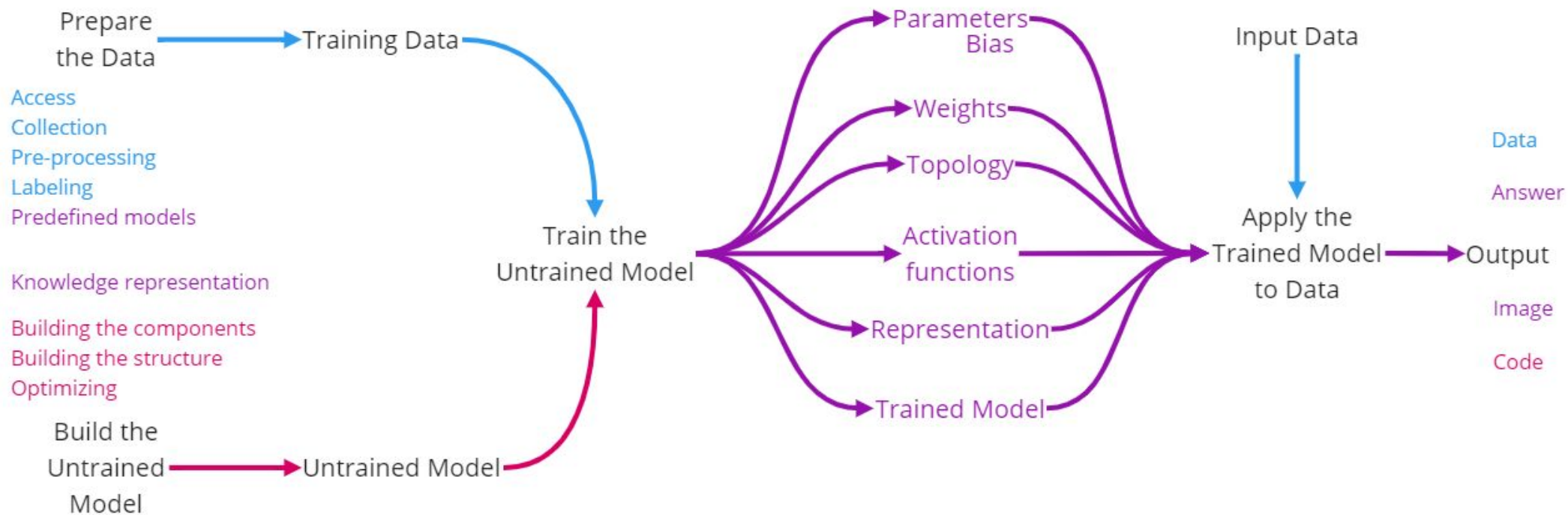**Exception or limitation for text and data mining**

1. Member States shall provide for an exception or limitation to the rights provided for in Article 5(a) and Article 7(1) of Directive 96/9/EC, Article 2 of Directive 2001/29/EC, Article 4(1)(a) and (b) of Directive 2009/24/EC and Article 15(1) of this Directive for reproductions and extractions of lawfully accessible works and other subject matter for the purposes of text and data mining.

2. Reproductions and extractions made pursuant to paragraph 1 may be retained for as long as is necessary for the purposes of text and data mining.

3. The exception or limitation provided for in paragraph 1 shall apply on condition that the use of works and other subject matter referred to in that paragraph has not been expressly reserved by their rightholders in an appropriate manner, such as machine-readable means in the case of content made publicly available online.

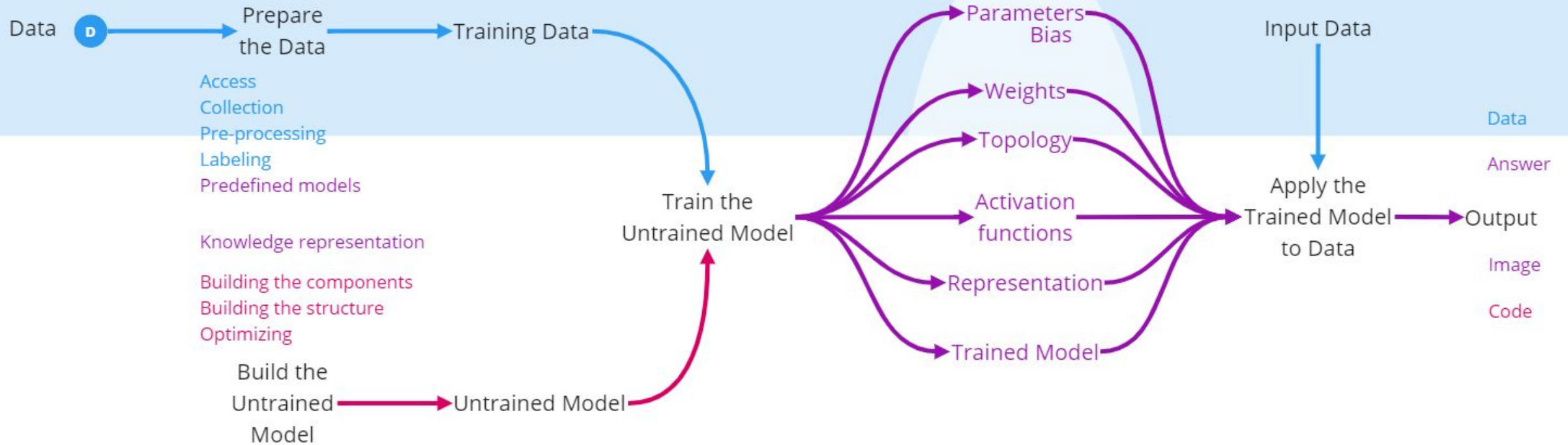4. This Article shall not affect the application of Article 3 of this Directive.

Input

Training data

Permissive open source licenses

Reciprocal open source licenses

Open Source

License?

OR

Exception?
Limitation?

Learned Model

generates objects

Computer Program?
Derivative Work / Adaptation?

Open Source?

Generated Code

Output

Computer Program
Derivative Work / Adaptation?

Open Source?

LAYERS IN AI

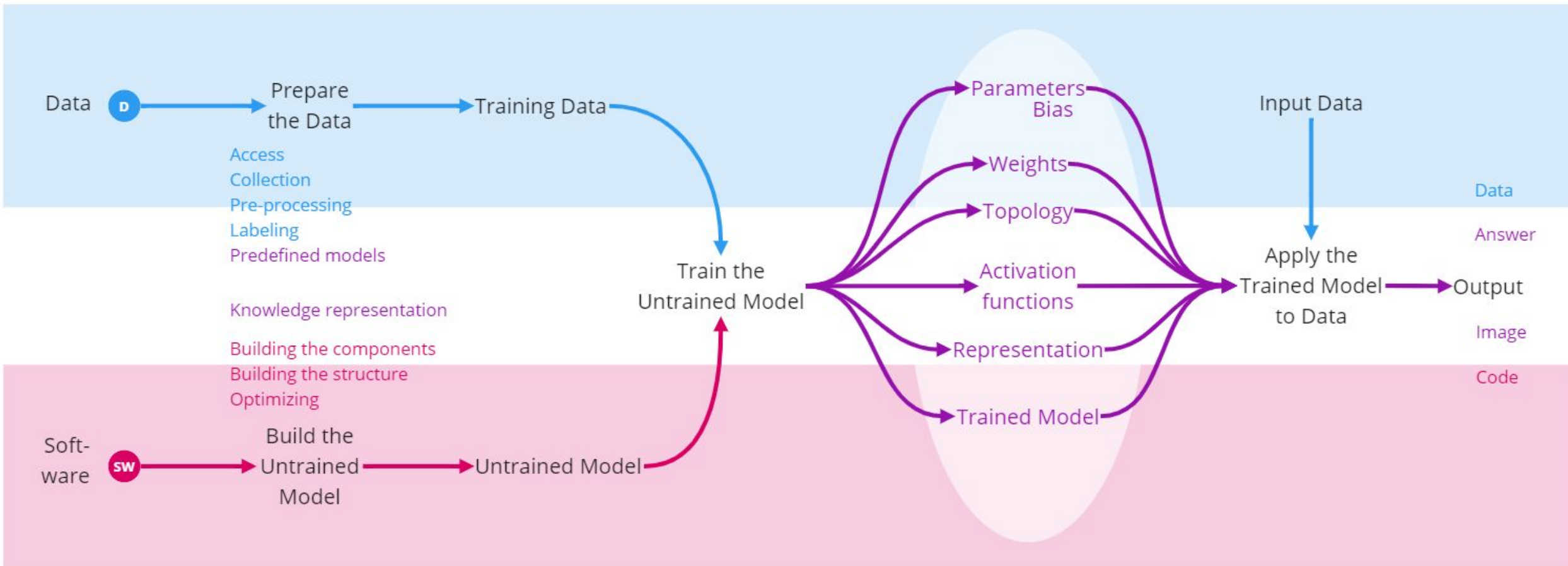Let's analyze different property layers involved in AI!
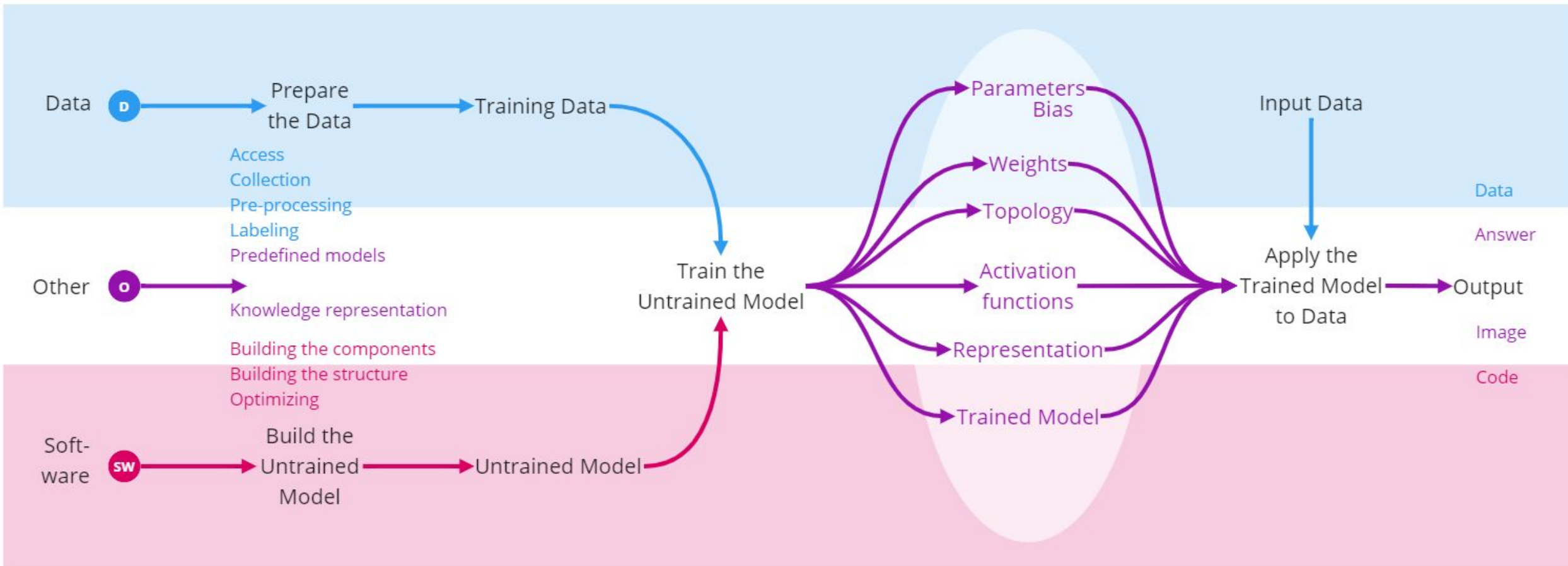
LAYERS IN AI
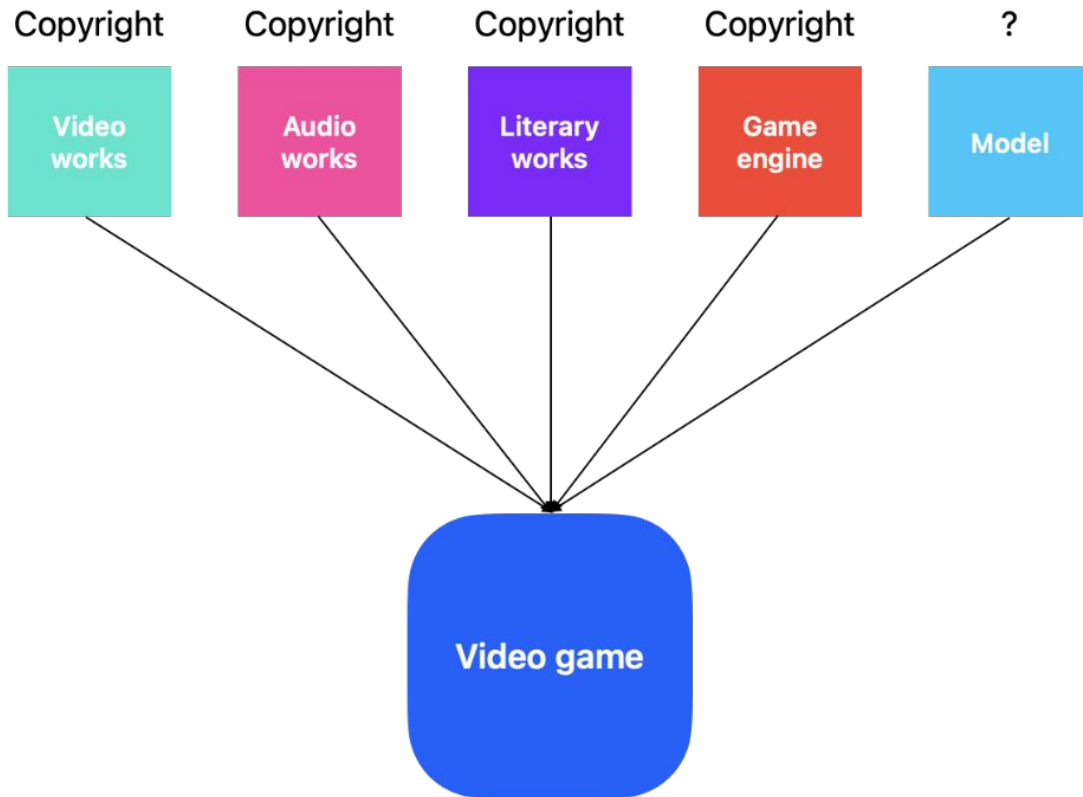
LAYERS IN AI

LAYERS IN AI

LAYERS IN AI

Deep dive into AI as hybrid IP

22. As regards the parts of a work, it should be borne in mind that there is nothing in Directive 2001/29 [InfoSoc Directive] indicating that those parts are to be treated any differently from the work as a whole. It follows that they are protected by copyright since, as such, they share the originality of the whole work (see Infopaq International, paragraph 38).
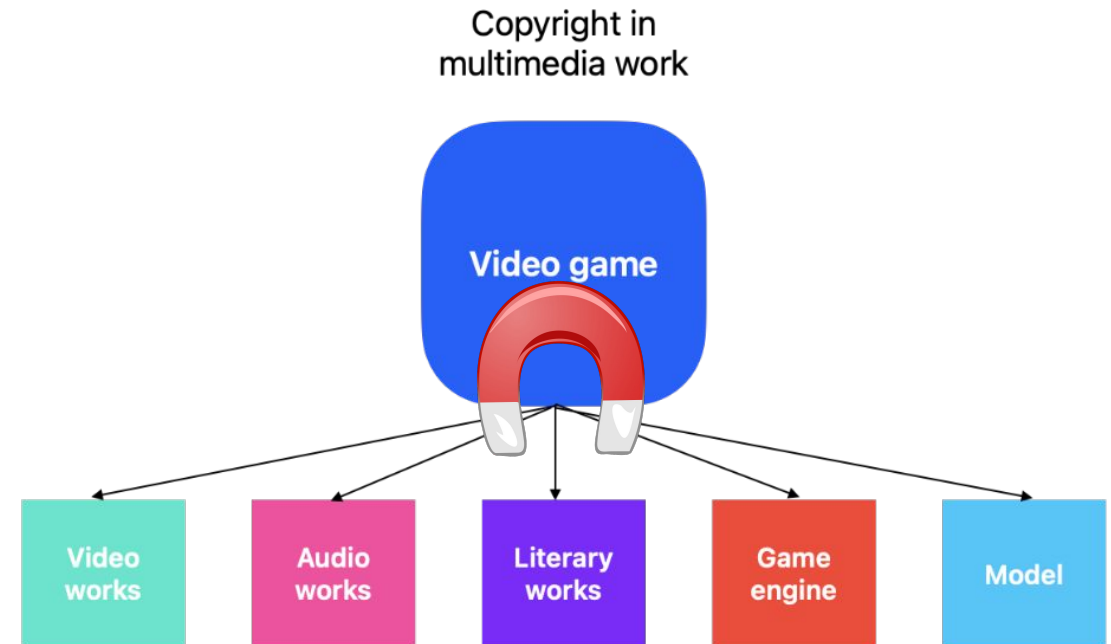
23. That finding is not weakened by the fact that Directive 2009/24 [Software Directive] constitutes a lex specialis in relation to Directive 2001/29 (see Case C-128/11 UsedSoft [2012] ECR, paragraph 56). In accordance with Article 1(1) thereof, the protection offered by Directive 2009/24 is limited to computer programs. As is apparent from the order for reference, videogames, such as those at issue in the main proceedings, constitute **complex matter** comprising not only a computer program but also graphic and sound elements, which, **although encrypted in computer language**, have a **unique creative value** which cannot be reduced to that encryption. In so far as the parts of a videogame, in this case, the graphic and sound elements, are part of its originality, they are protected, **together with the entire work**, by copyright in the context of the system established by Directive 2001/29.

Case C-355/12, *Nintendo v Pc Box*, ECLI:EU:C:2014:25

Closed subject matter systems

Copyright — Video works
Copyright — Audio works
Copyright — Literary works
Copyright — Game engine
? — Model

Video game

**Open subject matter systems
Unitary approach**

Copyright in multimedia work

Video game

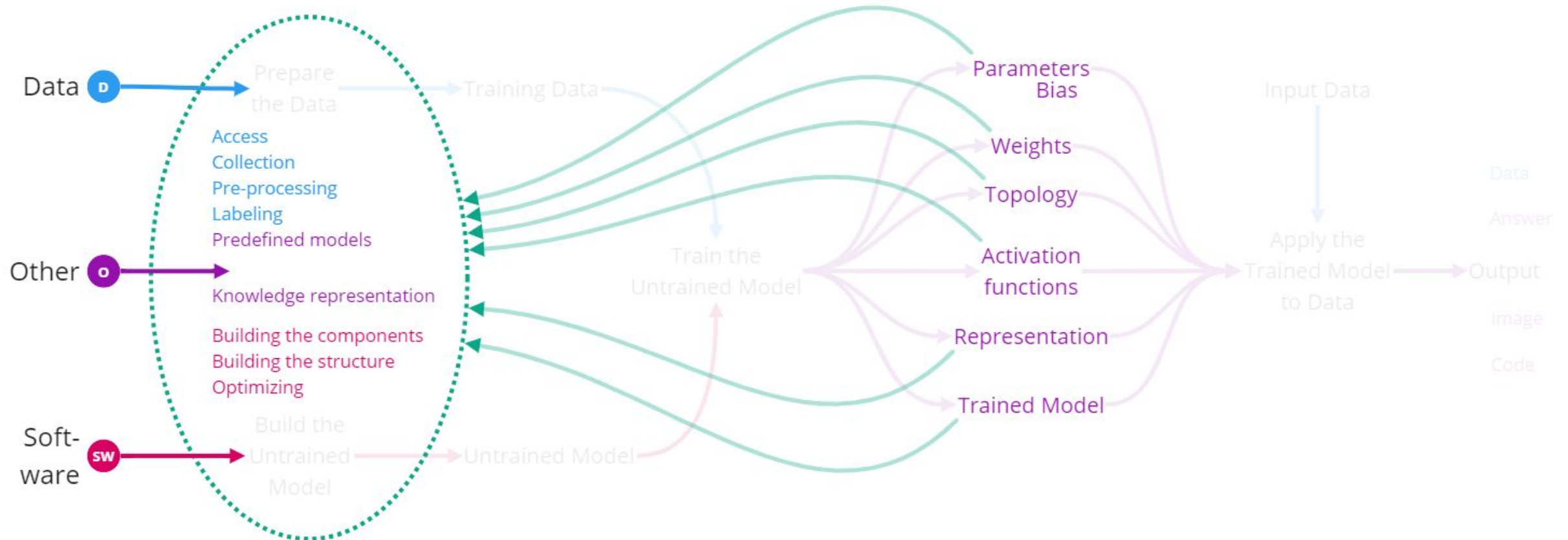Video works
Audio works
Literary works
Game engine
Model

BUILDING OPEN SOURCE AI

How to build similar dynamics to open source AI as we have for open source software?
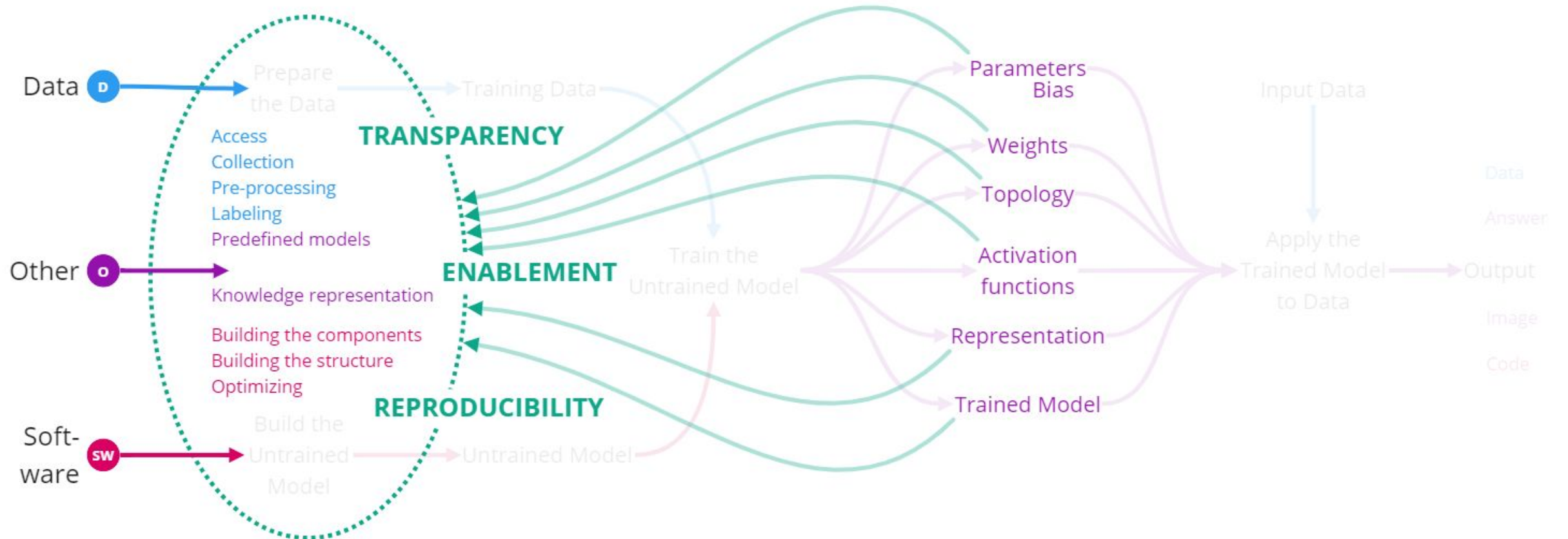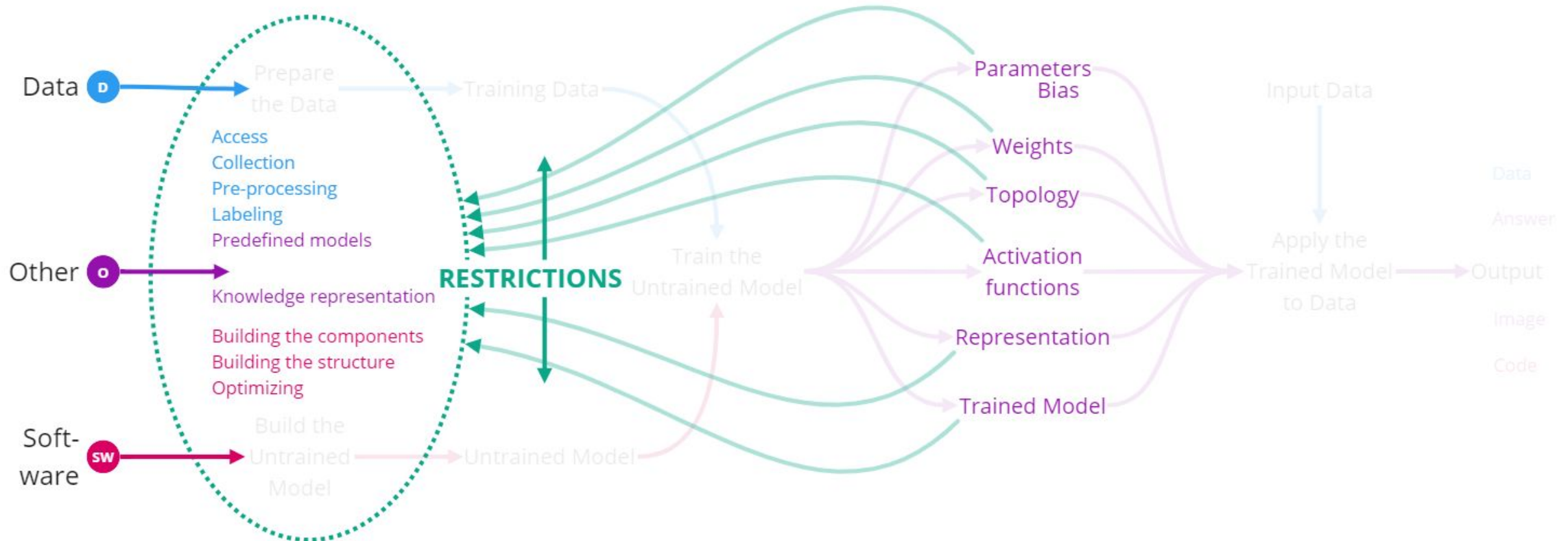
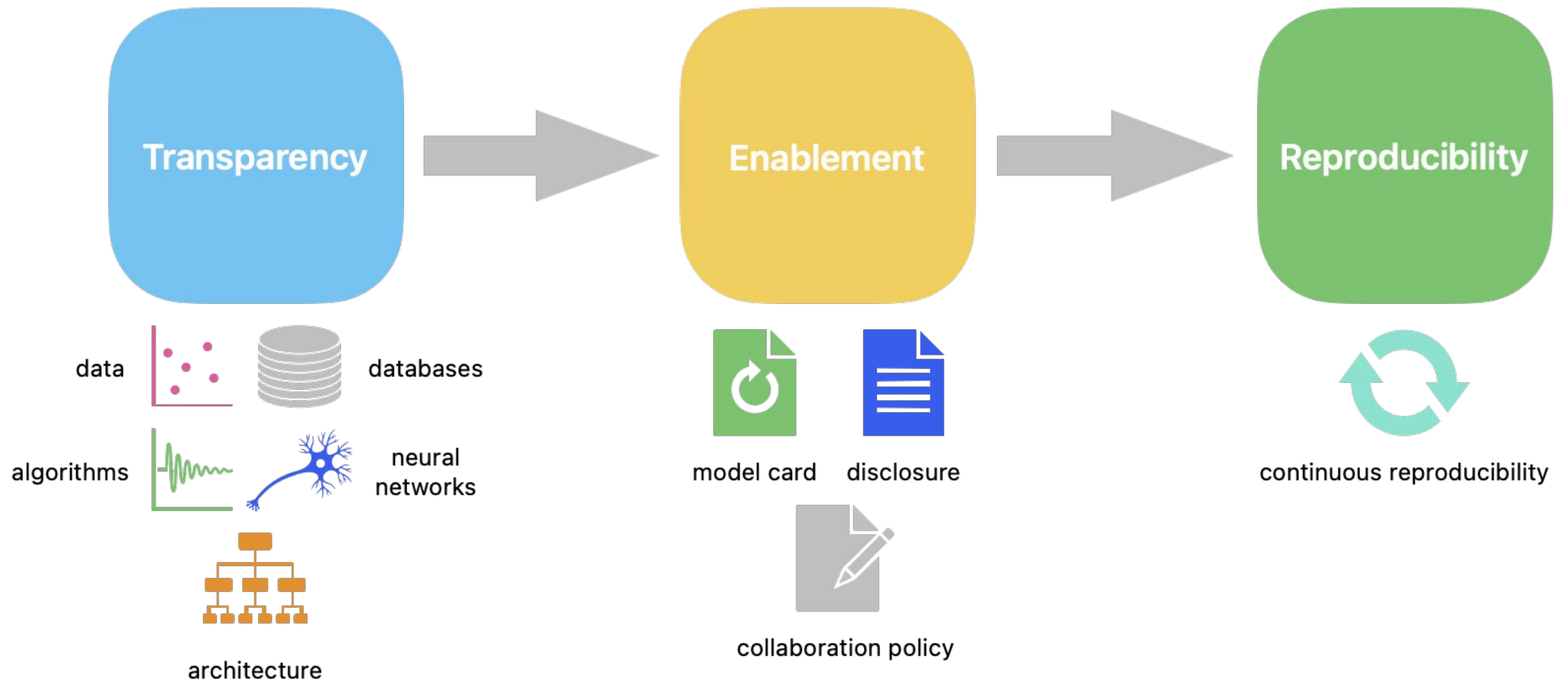# BUILDING OPEN SOURCE AI
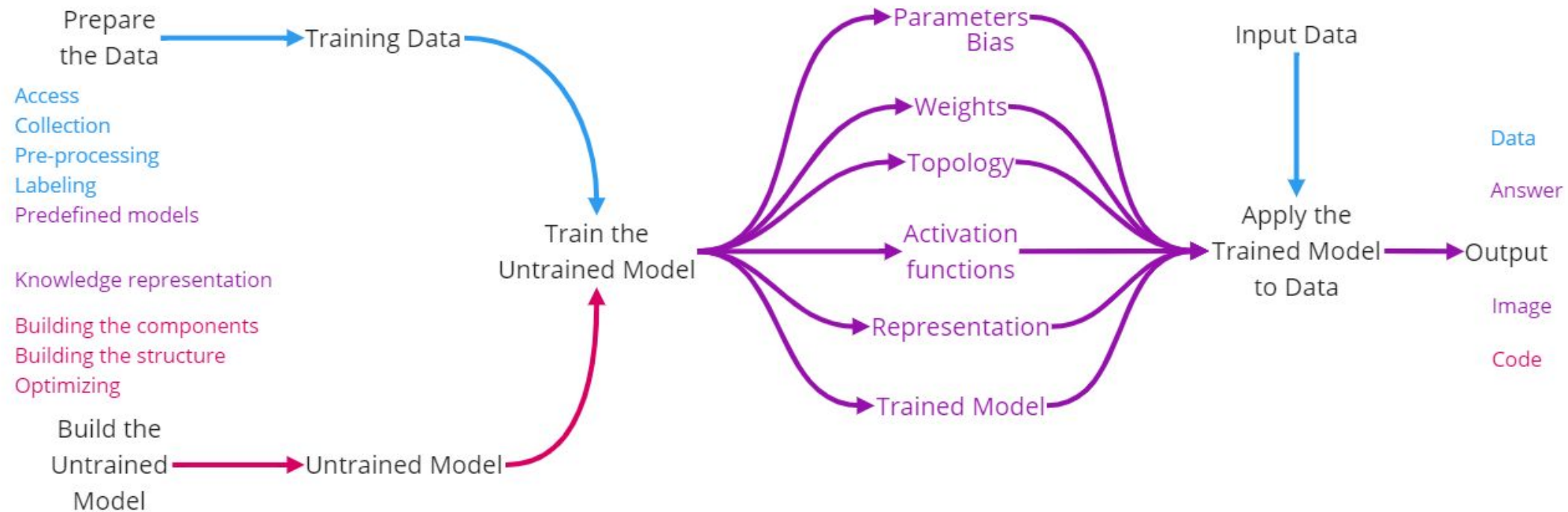
BUILDING OPEN SOURCE AI

BUILDING OPEN SOURCE AI

BUILDING OPEN SOURCE AI

Deep dive into the elements of an Open Source AI definition

Transparency → Enablement → Reproducibility

Transparency: data, databases, algorithms, neural networks, architecture

Enablement: model card, disclosure, collaboration policy

Reproducibility: continuous reproducibility

www.zooom4u.eu

EVOLVEMENT OF THE AI LICENSE SCENE

- Montreal data license (2019):
  - Taxonomy for licensing of data in AI and ML
  - Focus on data: the relationship betwen data and the models, not on openness
- Big Science BLOOM RAIL license 1.0 (2022)
  - Model specific
  - Focus on restrictions: open and permissive character while striving for responsible use of the model
- Open weights permissive license (2023):
  - Definition and license for open source compatible licensing of neural network weights (NNWs)
  - Focus on human-machine interactions: underlines the differences between open source software and NNWs with focus on openness

EVOLVEMENT OF THE AI LICENSE SCENE

OpenRAIL-DAMS licenses (2022)

- A family of licenses aiming to prevent irresponsible and harmful applications
- Focus on the restrictions and combinations of data, applications, models and source code
    - Data license
    - Application/Executable license
    - Model license
    - Source code license

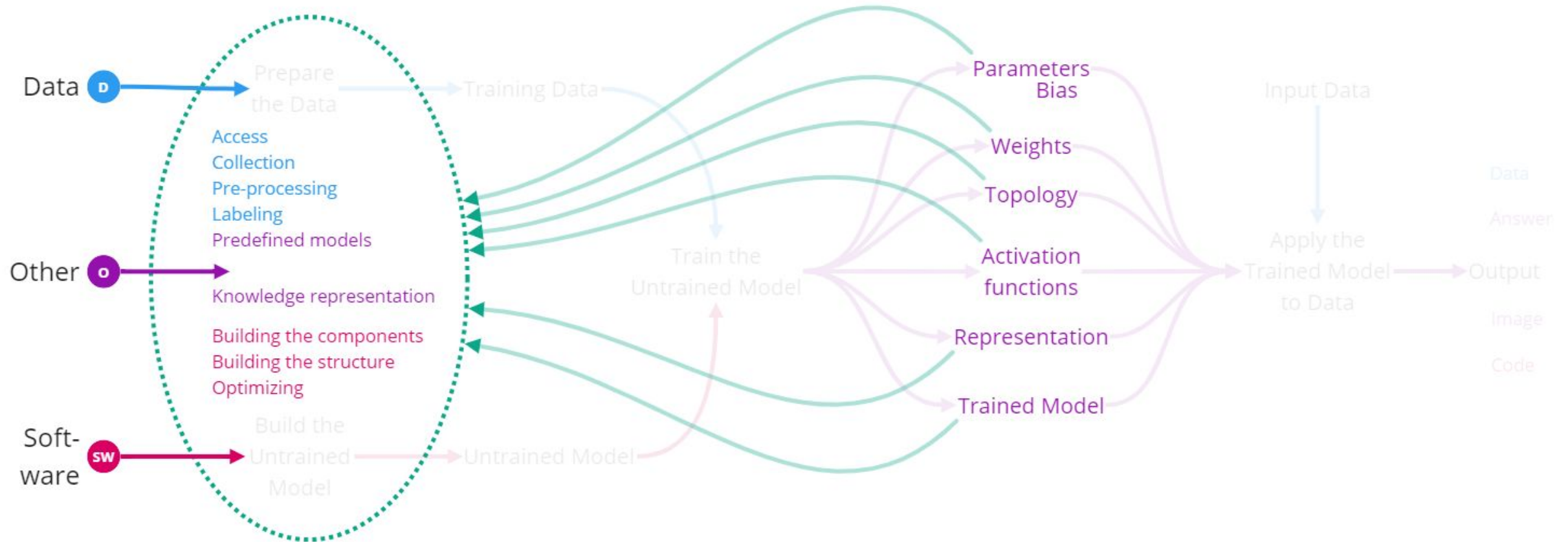# EVOLUTION OF THE AI LICENSE SCENE

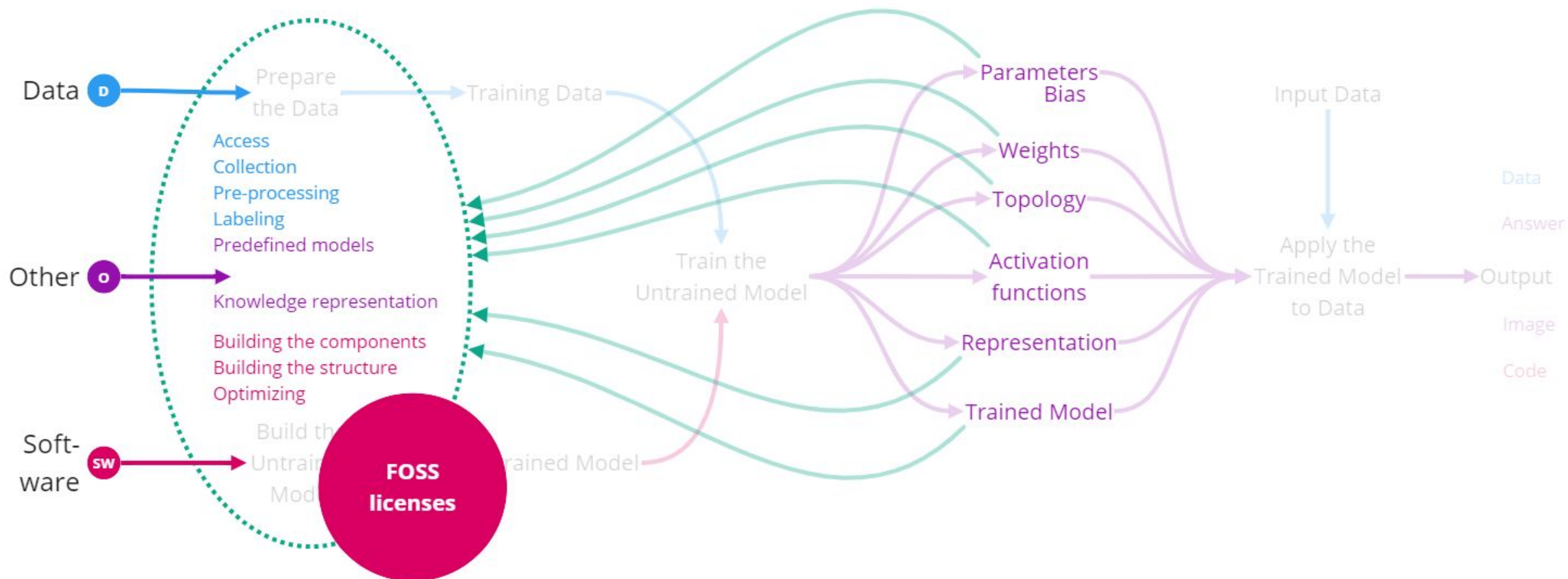## OpenRAIL-DAMS
Choosing the combination:
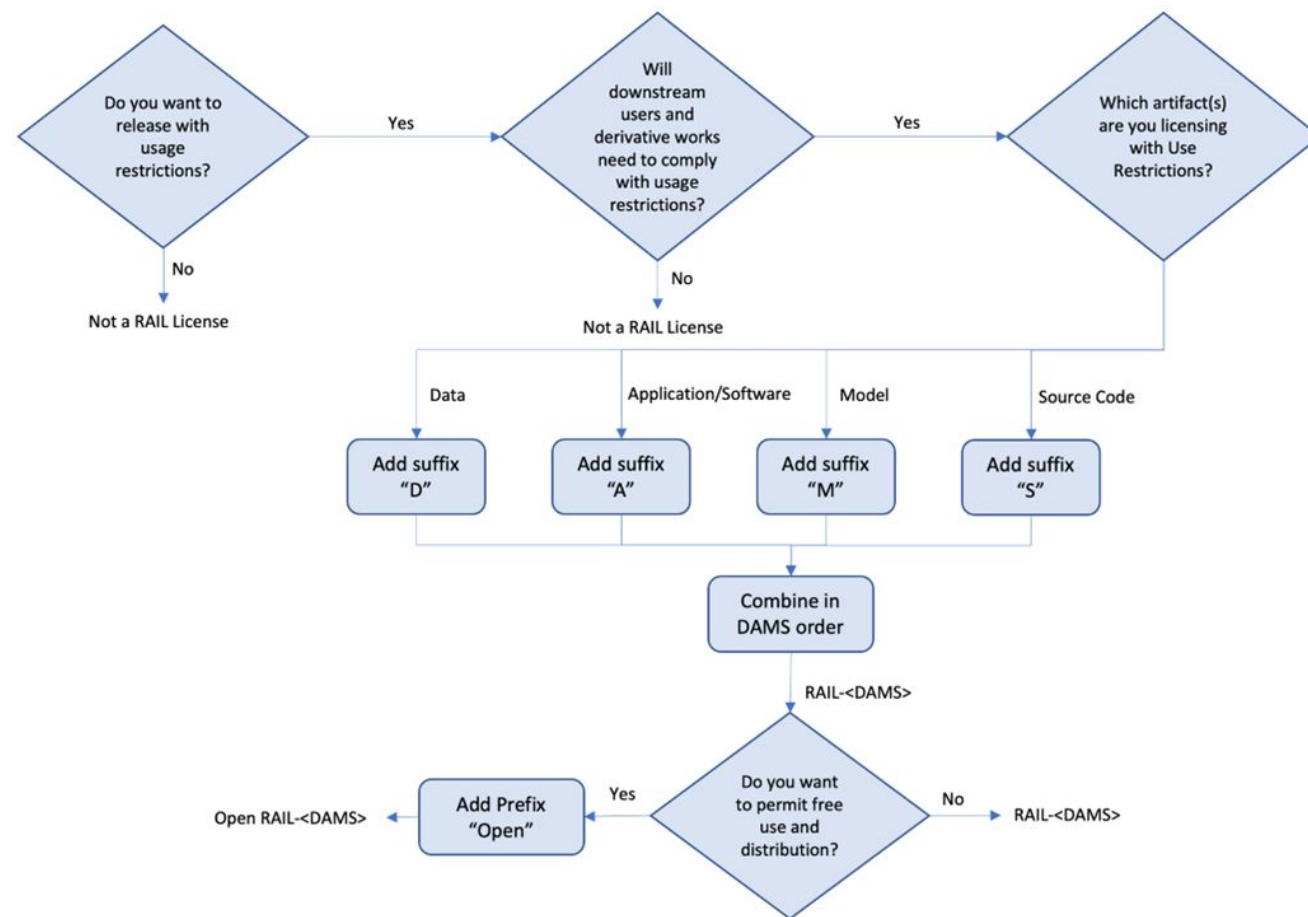
The OpenRAIL flow chart aids the selection and naming of a license for an ML project. Danish Contractor, Carlos Muñoz Ferrandis, Jenny Lee, & Daniel Mcduff. (2022, August)
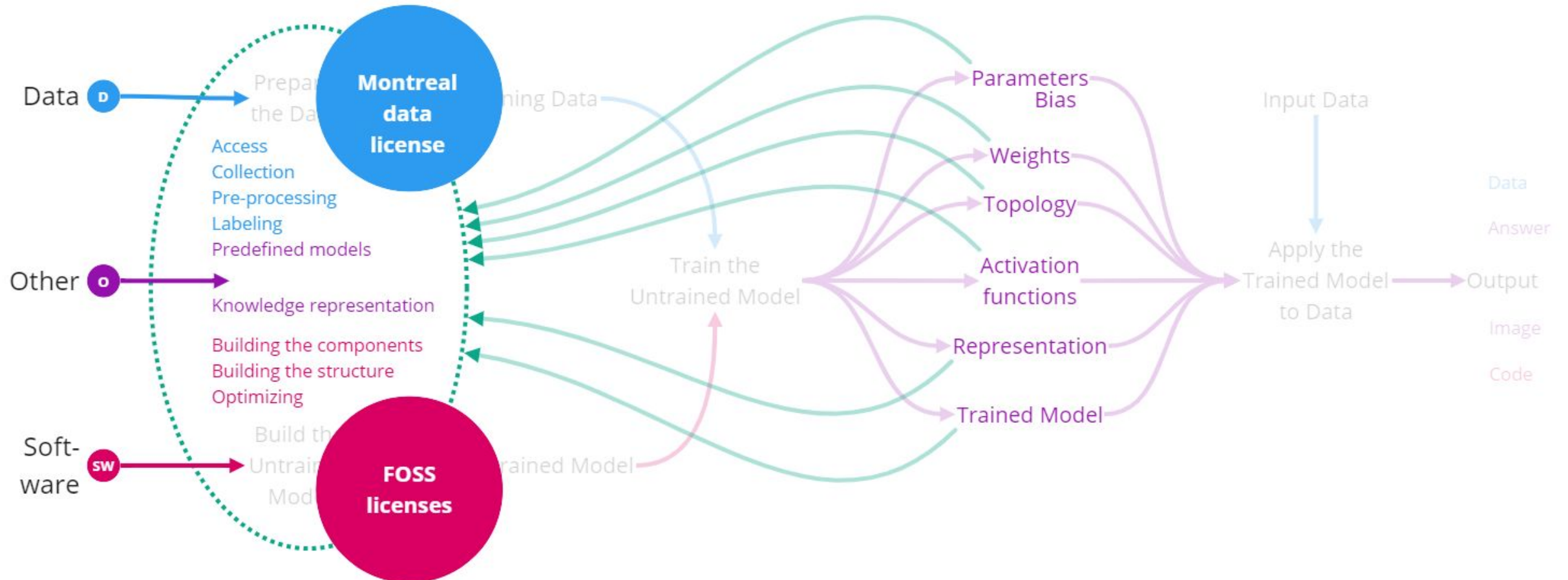
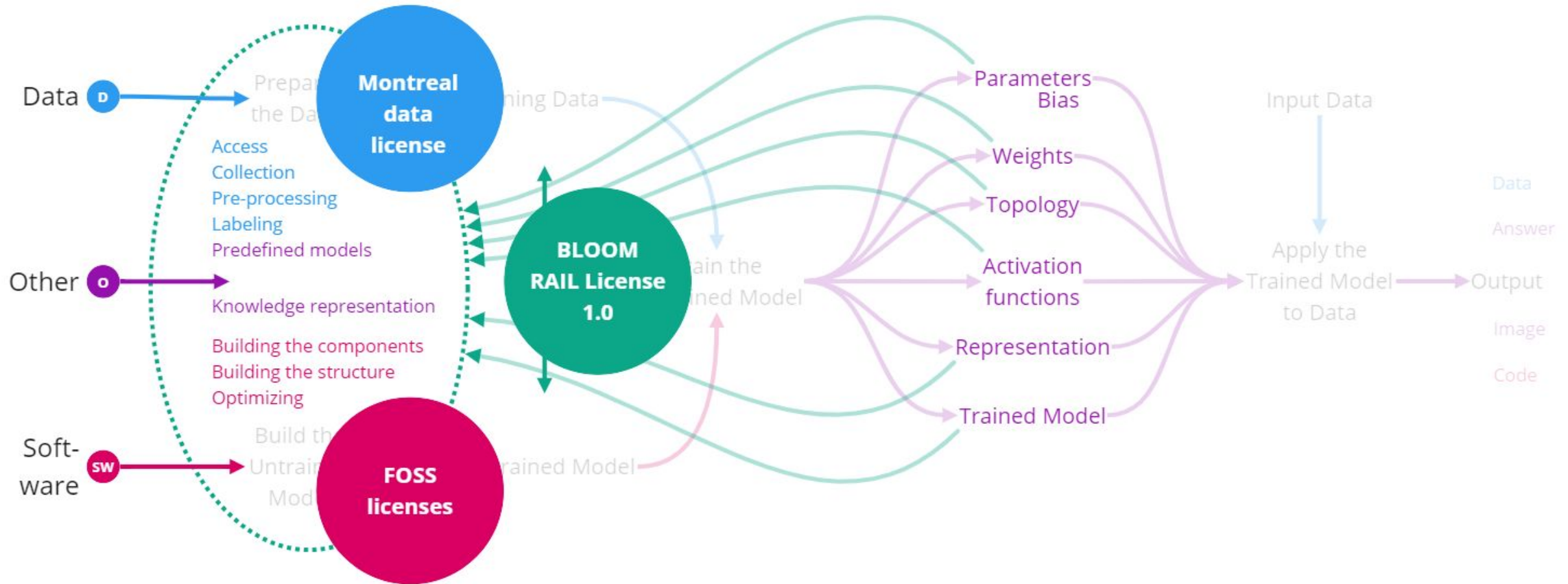# Learnings from the license scene to open source AI
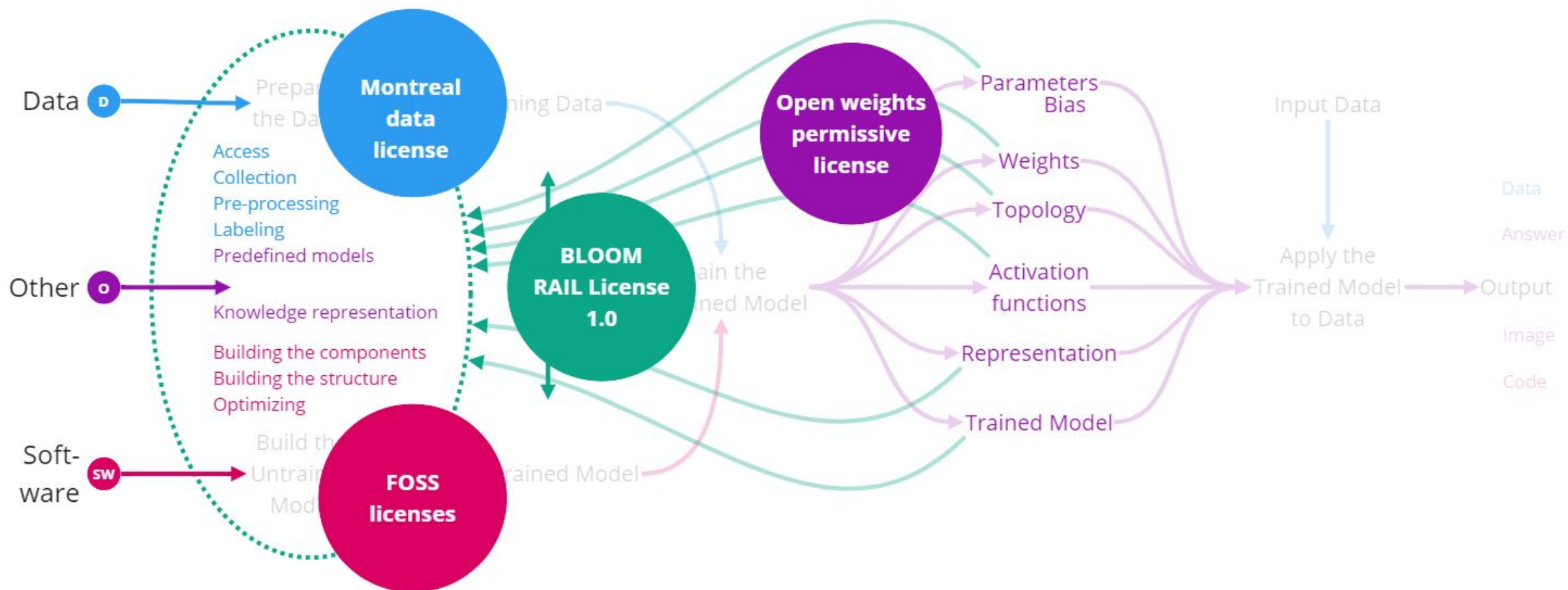
Learnings from the license scene to open source AI

Data **D** → Prepare the Data

Access
Collection
Pre-processing
Labeling
Predefined models

Knowledge representation

Building the components
Building the structure
Optimizing

Other **O** →

Soft-ware **SW** → Build the Untrained Model

Training Data

Train the Untrained Model

Untrained Model

FOSS licenses

Parameters
Bias
Weights
Topology
Activation functions
Representation
Trained Model

Input Data

Apply the Trained Model to Data

Output

Data
Answer
Image
Code

Learnings from the license scene to open source AI

Learnings from the license scene to open source AI

Data (D)

Montreal data license

Access
Collection
Pre-processing
Labeling
Predefined models

Other (O)

Knowledge representation

Building the components
Building the structure
Optimizing

Soft-ware (SW)

FOSS licenses

BLOOM RAIL License 1.0

Parameters
Bias

Weights

Topology

Activation functions

Representation

Trained Model

Input Data

Apply the Trained Model to Data

Output

Data

Answer

Image

Code

Learnings from the license scene to open source AI

Learnings from the license scene to open source AI

ADOPTION OF AI LICENSES

Adoption of RAIL licenses:

"According to a recent <u>paper</u> *that analyzed licenses attached to models on the HuggingFace hub, between* September 2022 and January 2023, *Open RAIL licenses have overtaken all other categories of restrictive open source licenses, and are now* the second most used category after permissive open source software licenses*."*

<u>Growth and Adoption of RAIL Licenses — Responsible AI Licenses (RAIL)</u>

REGULATORY REQUIREMENTS AND IMPACT

Stanford Research on Foundation Models

Grading foundation model providers' compliance with the draft EU AI Act:

Grading Foundation Model Providers' Compliance with the Draft EU AI Act

Source: Stanford Research on Foundation Models (CRFM), Institute for Human-Centered Artificial Intelligence (HAI)

Draft AI Act Requirements	GPT-4 (OpenAI)	Cohere Command (cohere)	Stable Diffusion v2 (stability.ai)	Claude (ANTHROP\C)	PaLM 2 (Google)	BLOOM (BigScience)	LLaMA (Meta)	Jurassic-2 (AI21 labs)	Luminous (Aleph Alpha)	GPT-NeoX (EleutherAI)	Totals
Data sources	●○○○	●●●○	●●●●	○○○○	●●○○	●●●●	●●●●	○○○○	○○○○	●●●○	22
Data governance	●●○○	●●●○	●●○○	○○○○	●●●○	●●●○	●●○○	○○○○	○○○○	●●●○	19
Copyrighted data	○○○○	○○○○	○○○○	○○○○	○○○○	●●●●	○○○○	○○○○	○○○○	●●●●	7
Compute	○○○○	○○○○	●●●●	○○○○	●●●○	●●●○	●●●●	○○○○	●○○○	●●●○	17
Energy	○○○○	●●○○	●●●●	○○○○	●●●●	●●●○	●●●○	○○○○	○○○○	●●○○	16
Capabilities & limitations	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●○	●●●○	●●○○	●●●○	27
Risks & mitigations	●●●○	●●●○	●●○○	●●●○	●●●○	●●●○	●●○○	●●○○	○○○○	●○○○	16
Evaluations	●●●○	●●●○	●●●○	○○○○	●●●○	●●○○	●●○○	●○○○	●○○○	●○○○	15
Testing	●●●○	●●○○	●●●○	○○○○	○○○○	●●○○	●○○○	●○○○	○○○○	○○○○	10
Machine-generated content	●●●●	●●●●	●○○○	●●●●	●●●○	○○○○	○○○○	●●●○	●○○○	●●○○	21
Member states	●●○○	○○○○	○○○○	●●○○	●●○○	○○○○	○○○○	○○○○	○○○○	●○○○	9
Downstream documentation	●●●●	●●●●	●●●●	○○○○	●●●○	●●●○	●●○○	○○○○	○○○○	●●●○	24
Totals	25 / 48	23 / 48	22 / 48	7 / 48	27 / 48	36 / 48	21 / 48	8 / 48	5 / 48	29 / 48	

@misc{bommasani2023eu-ai-act, author = {Rishi Bommasani and Kevin Klyman and Daniel Zhang and Percy Liang}, title = {Do Foundation Model Providers Comply with the EU AI Act?}, url = {https://crfm.stanford.edu/2023/06/15/eu-ai-act.html}, year = {2023}}
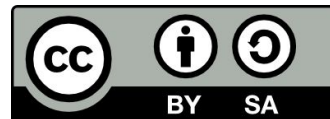
LEARNING TO UNDERSTAND HYBRID TECHNOLOGIES

[ZOOOM – 3Os and IP awareness raising for collaborative ecosystems (zooom4u.eu)](https://zooom4u.eu)

- Focusing on hybrids of open source software, open hardware and open data
- Emphasis on 4 emerging technologies: AI, Blockchain, Quantum, Robotics
- Bridging the understanding between legal aspects and business aspects
- Practical tools to be identified and a toolbox developed
- Stay tuned!

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TIME FOR DISCUSSION!