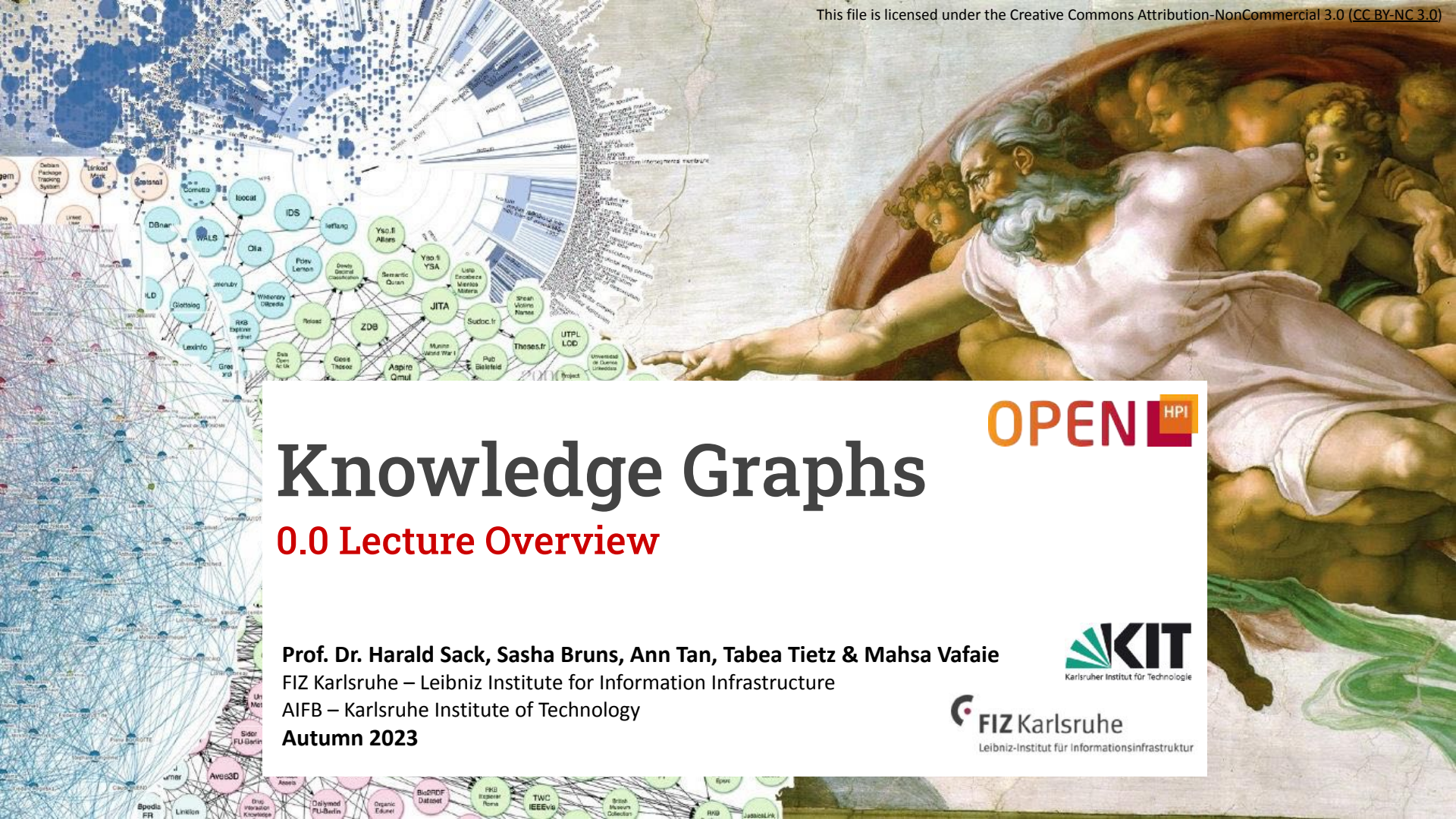

Knowledge Graphs

0.0 Lecture Overview

Prof. Dr. Harald Sack, Sasha Bruns, Ann Tan, Tabea Tietz & Mahsa Vafaie
FIZ Karlsruhe – Leibniz Institute for Information Infrastructure
AIFB – Karlsruhe Institute of Technology
Autumn 2023

Knowledge Graphs

0.0 Lecture Overview

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Knowledge Graphs

Lecture 1: Knowledge Representation with Graphs

1.1 From Data to Knowledge
1.2 Knowledge and how to represent it
1.3 The Art of Understanding
1.4 Graphs and Triples
1.5 Knowledge Graphs
1.6 The Semantic Web
1.7 Linked Data and the Web of Data

Additional Hands-On:

Hands-On 1.1 Graph Creation from Text
Hands-On 1.2 The Art of Understanding: Natural Language Processing
Hands-On 1.3 NLP Ambiguities

[1]

Knowledge Graphs

Lecture 2: Basic Knowledge Graph Infrastructure

2.1 How to Identify and Access Things
2.2 How to Represent Simple Facts with RDF
2.3 RDF Turtle Serialization
2.4 Vocabularies and Model Building with RDFS
2.5 RDF Complex Data Structures
Excursion 1: RDF Reification and RDF*
2.6 Logical Inference with RDF(S)
Excursion 2: RDFa – RDF and the Web

Additional Hands-On:

Hands-On 2.1 RDFLib - RDF Serialization and Visualization
Hands-On 2.2 RDFLib - RDF Graph Manipulation

[2]

Knowledge Graphs

Lecture 3: Querying Knowledge Graphs with SPARQL

3.1 How to Query RDF(S)
Excursion 3: DBpedia Knowledge Graph
Excursion 4: Wikidata Knowledge Graph
3.2 Complex Queries with SPARQL
3.3 More Complex SPARQL Queries
3.4 SPARQL Sub-Select and Property Paths
3.5 SPARQL is more than a Query Language
3.6 Quality Assurance with SHACL Constraints

Additional Hands-On:

Hands-On 3.1 Querying Knowledge Graphs with SPARQL - Wikidata
Hands-On 3.2 Querying Knowledge Graphs with SPARQL - DBpedia
Hands-On 3.3 SPARQL Query Federation

[3]

Knowledge Graphs

Lecture 4: Ontologies as Key to Knowledge Representation

4.1 From Aristotle to AI: Exploring Ontologies in Computer Science
4.2 The Crucial Role of Mathematical Logic
Excursion 5: Essential Logics in a Nutshell
Excursion 6: Description Logics
4.3 The Web Ontology Language OWL
4.4 From simple to complex: Scaling up with OWL
4.5 Unlocking the Potential of OWL

Additional Hands-On:
Hands-On 4.1 Introduction to Protégé Web and Desktop
Hands-On 4.2 Reasoning with Protégé

[4]

Knowledge Graphs

Lecture 5: Ontological Engineering for Smarter Knowledge Graphs

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5.1 Beyond the Limits of OWL
Excursion 7: The Semantic Web Rule Language SWRL
5.2 How to design your own Ontology
5.3 How to design better Ontologies
5.4 Ontological Engineering
5.5 Knowledge Graph Construction
5.6 Ontologies & Knowledge Graphs – Best Practices

Additional Hands-On:

Hands-On 5.1 NLP and Knowledge Graph Construction
Hands-On 5.2 Knowledge Graph Construction with OpenRefine
Hands-On 5.3 SWRL

Knowledge Graphs

Lecture 6: Intelligent Applications with Knowledge Graphs and Deep Learning

Additional Hands-On:

Hands-On 6.1 Network Analysis

Hands-On 6.2 Introduction to Knowledge Graph Completion using TransE

[6]

Knowledge Graphs

0.0 Lecture Overview

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Picture References:

[1] LOD Cloud, 2014-08-30, [cc-by-4.0], https://lod-cloud.net/versions/2014-08-30/lod-cloud.png

[2] "The Resource Description Framework (RDF) is a W3C standard originally designed as a data model for metadata…" , created via ArtBot, Anything Diffusion - generic scifi, 2023, [CC-BY-4.0], https://tinybots.net/artbot

[3] "A dystopian city street scene clearly exhibiting the consequences of both unchecked population growth on society and the hoarding of resources by a wealthy minority in the style of a 1960s pulp cover.", created via ArtBot, Deliberate, 2023, [CC-BY-4.0], https://tinybots.net/artbot

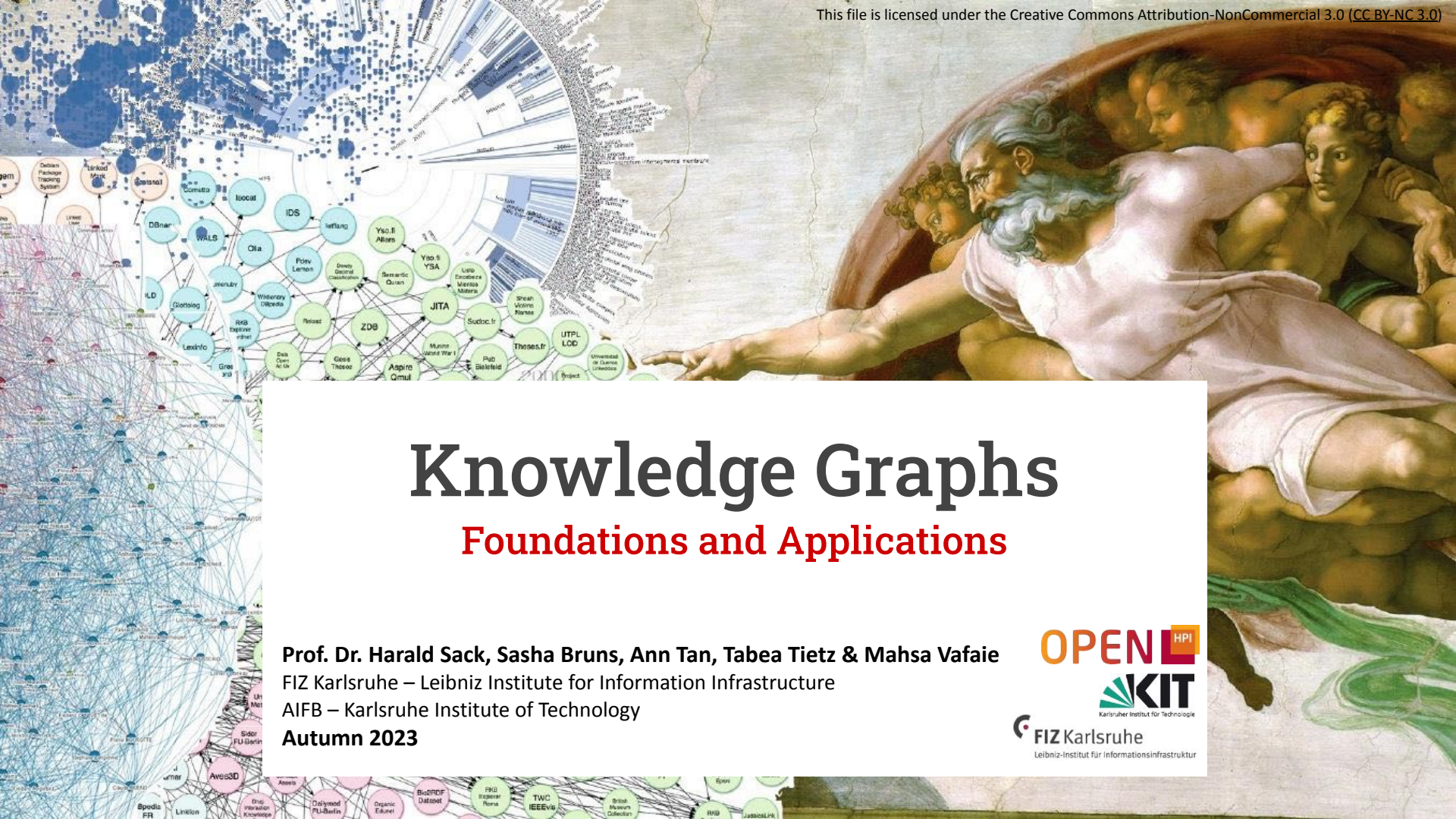
[4] ArtBot, Deliberate, 2023, [CC-BY-4.0], https://tinybots.net/artbot

[5] "A large owl in a space suit floating in deep space next to its spaceship over the surface of Mars.", created via ArtBot, Deliberate, 2023, [CC-BY-4.0], https://tinybots.net/artbot

[6] On this colorized Renaissance woodcut we see two sailing ships driven towards the edge of flat Earth. Underneath the waves there lures a fierce dragon. The ocean's waters are pouring down from the edge of flat Earth..", created via ArtBot, Deliberate, 2023, [CC-BY-4.0], https://tinybots.net/artbot

[7] "An image of the Semantic Web which is an extension of the World Wide Web…" , created via ArtBot, stable diffusion - generic scifi, 2023, [CC-BY-4.0], https://tinybots.net/artbot

[7]



Knowledge Graphs

Foundations and Applications

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