Beyond Deep Learning: Selected Topics
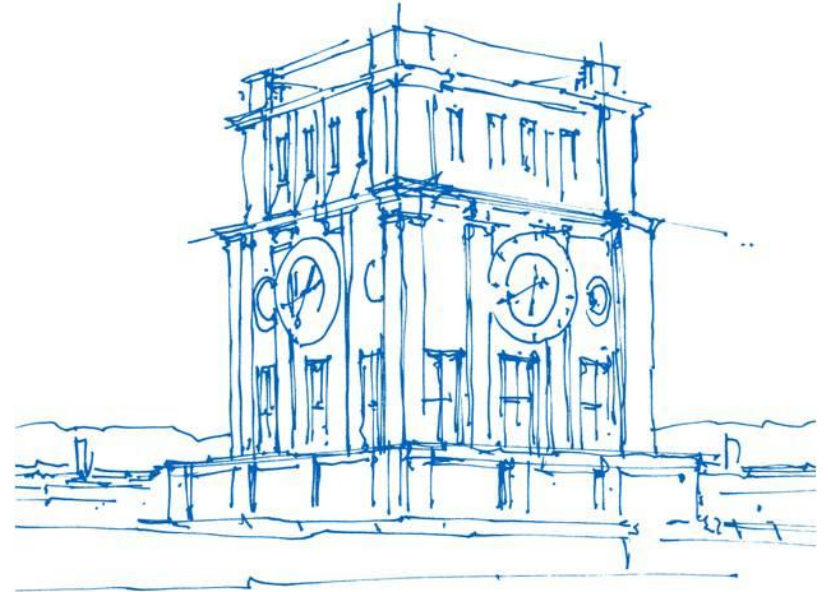
Felix Wimbauer

Technical University of Munich

Chair of Computer Vision and Artificial Intelligence

Garching,

July, 11th, 2024

Agenda

- Who am I

- What are the topics we will cover?

- How is the course organized?

- How to apply?

Felix Wimbauer

Background:

- 3rd year PhD student

- TUM, University of Oxford

Research Interests:

- (Dynamic) 3D Reconstruction,Object-centric learning, Diffusion Models, Bayesian Approaches, MCMC
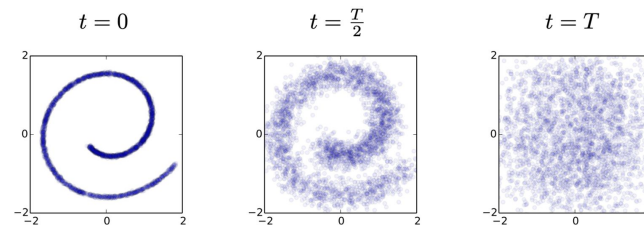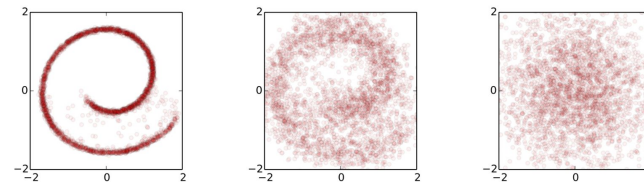
Website:

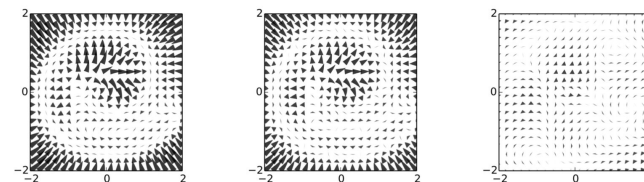vision.in.tum.de/members/wimbauer

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Topics

Diffusion Models

The forward trajectory
$q(\mathbf{x}_{0:T})$

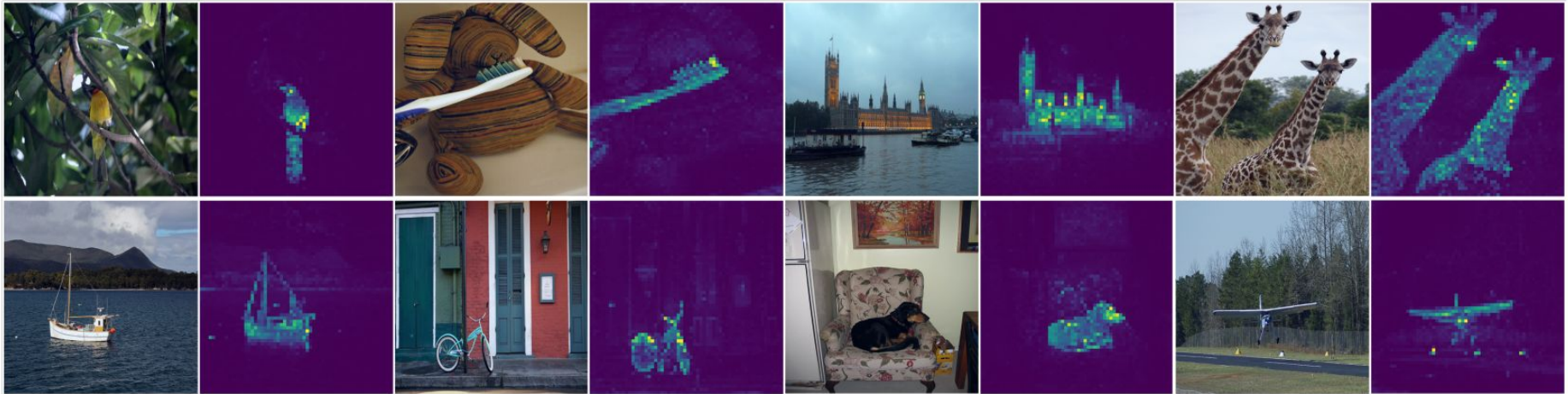The reverse trajectory
$p_\theta(\mathbf{x}_{0:T})$

The drifting term
$\boldsymbol{\mu}_\theta(\mathbf{x}_t, t) - \mathbf{x}_t$

- Dall E 2, Ramesh et al, 2022
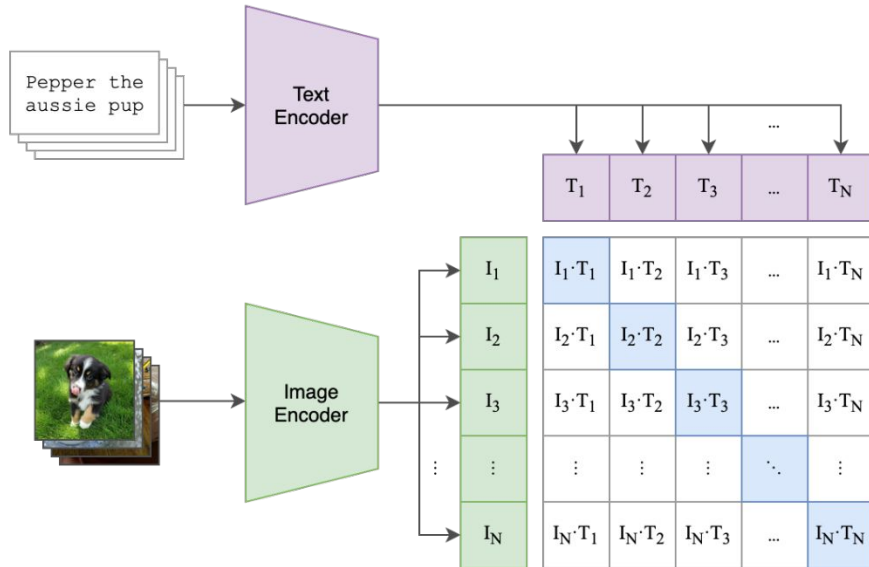- Dhariwal et al 2021
- …

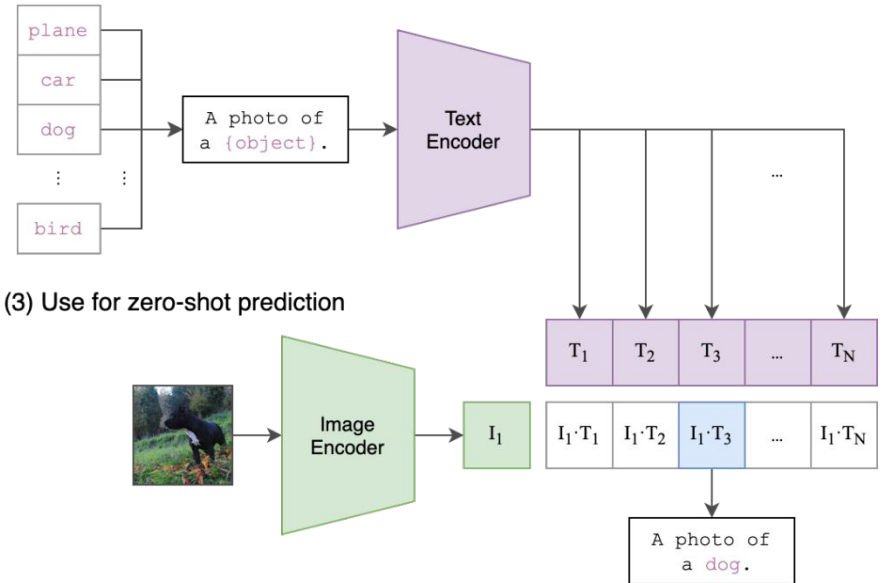# DINO - Student-teacher models for self-supervised rep. learning

- DINO, Caron et al 2021
- …

CLIP - Representation Learning for Text and Images

(1) Contrastive pre-training

(2) Create dataset classifier from label text

(3) Use for zero-shot prediction

- Clip, Radford et al., 2021
- SigLIP, Zhai et al., 2023
- …

Multimodal Language Models

PaLM-E: An Embodied Multimodal Language Model
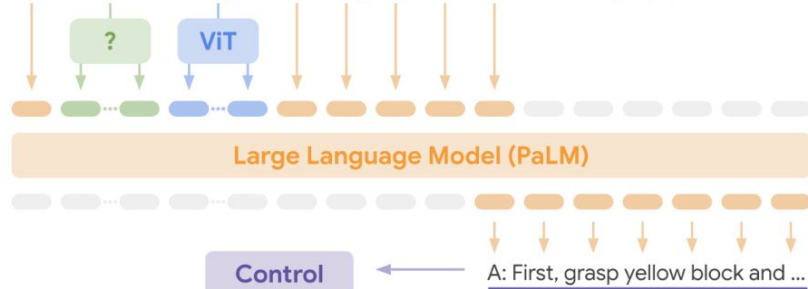
- PaLM-E, Driess et al., 2023
- Many more

Segment Anything and Follow-Ups
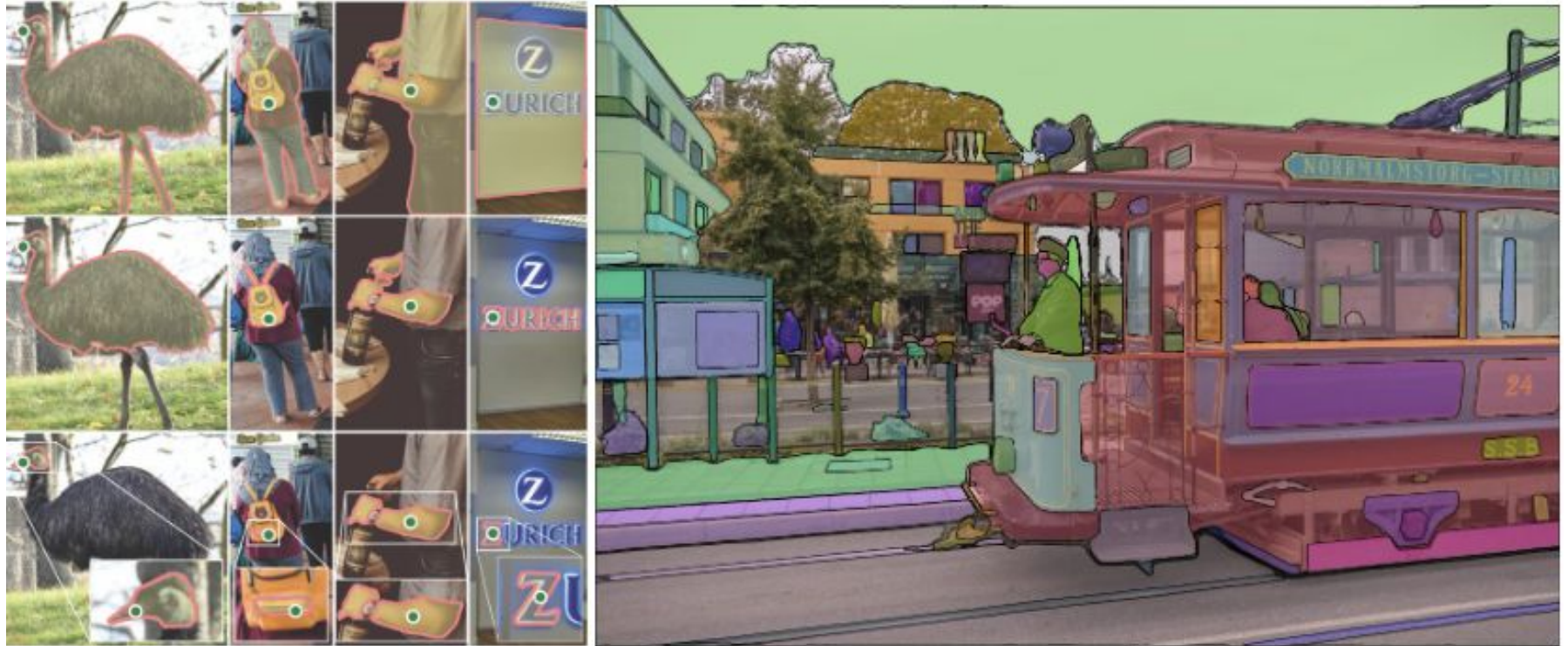
- Segment Anything, Kirillov et al., 2023
- GroundedSAM, UnSAM
- Many more

Datasets and Dataset Curation

The FineWeb pipeline
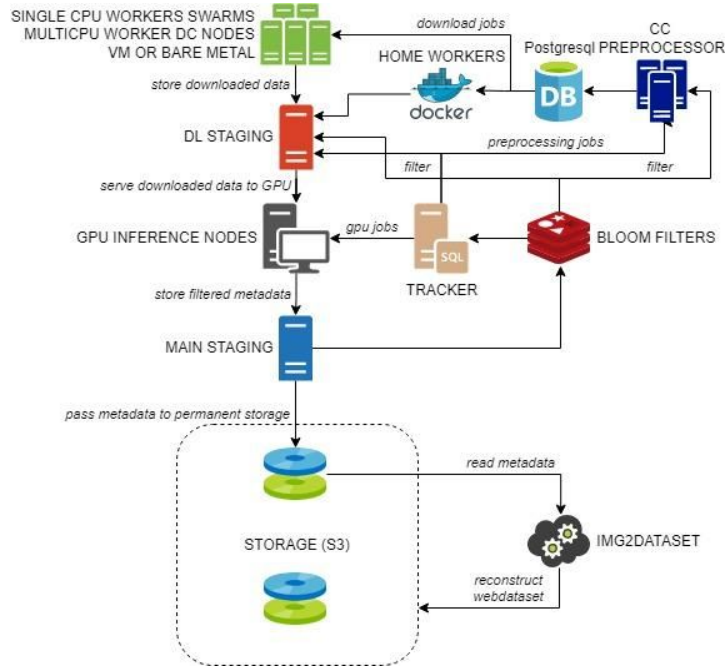
🤗 Hugging Face

🍷 **FineWeb**

LAION 🐾

Course logistics

Course Organization

Course website: https://cvg.cit.tum.de/teaching/ws2024/bdl

Course email (for now): felix.wimbauer@tum.de

Course structure:

- Kick-Off Meeting with all the topics (default date: Oct 16th)
- Matching to the topics
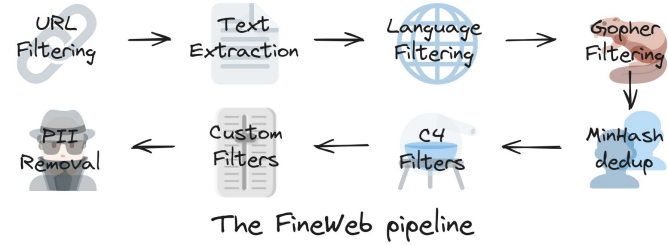- Read the papers and do a literature search and elaborate on the topic you are provided with
- Get optional help, if you did not understand the paper
- Send a first draft of the presentation and get optional feedback
- Presentations take place mid January
- Final report will be due one week after the presentations

Prerequisites

- Machine learning & deep learning knowledge:

  Basic ML concepts and ML/DL models

  Min. Requirement: passed one ML/DL related course (I2ML, I2DL, ADL4CV, PGM ...)

- Soft skills:

  Manage regular workflow and communicate with tutors efficiently

- We also value:

  - solid basis & interest for maths

  - prior experience with ML/DL projects

How to apply

1. Apply via the **TUM Matching system** (until July 16th, 2023)

    ○ If you like our course, make sure to give it a high priority :)

2. **Send us an email** to show your interest and fulfillment of prerequisites

    ○ Crucial for us to give you a priority

- The email should be sent to us **latest on July 16** with the title

  "[BDL] <Firstname> <Lastname>" and contain

    ○ Filled information form (template on course website, rename to "firstname_lastname.xlsx")

    ○ Transcript

    ○ CV

- Course Website: https://cvg.cit.tum.de/teaching/ws2024/bdl

Thank you! Questions?