ETH zürich

Distributed Computing Group

Seminar in Deep Neural Networks 2025

Frédéric Berdoz, Benjamin Estermann
18th of February 2025

Introduce yourself!

- Name
- Degree, Background in Machine Learning (theoretical and/or practical)
- What are your expectations for the seminar?
- What do you want to learn?

Supervisors

Andreas

Benjamin

Frédéric

Florian

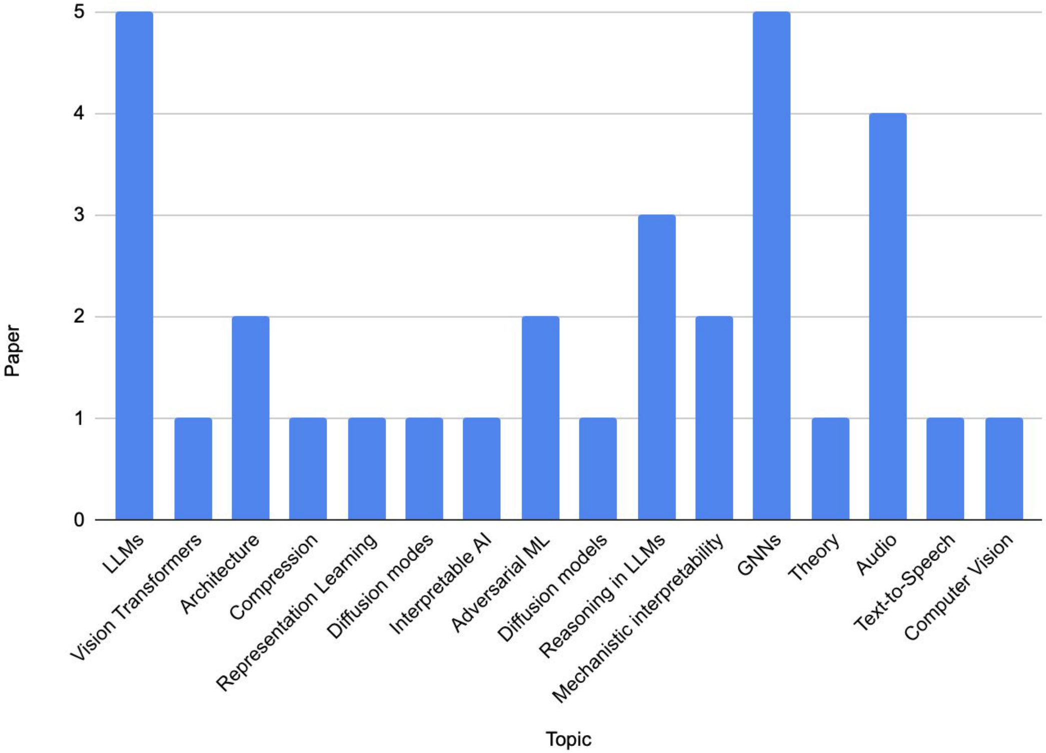
Till

Luca

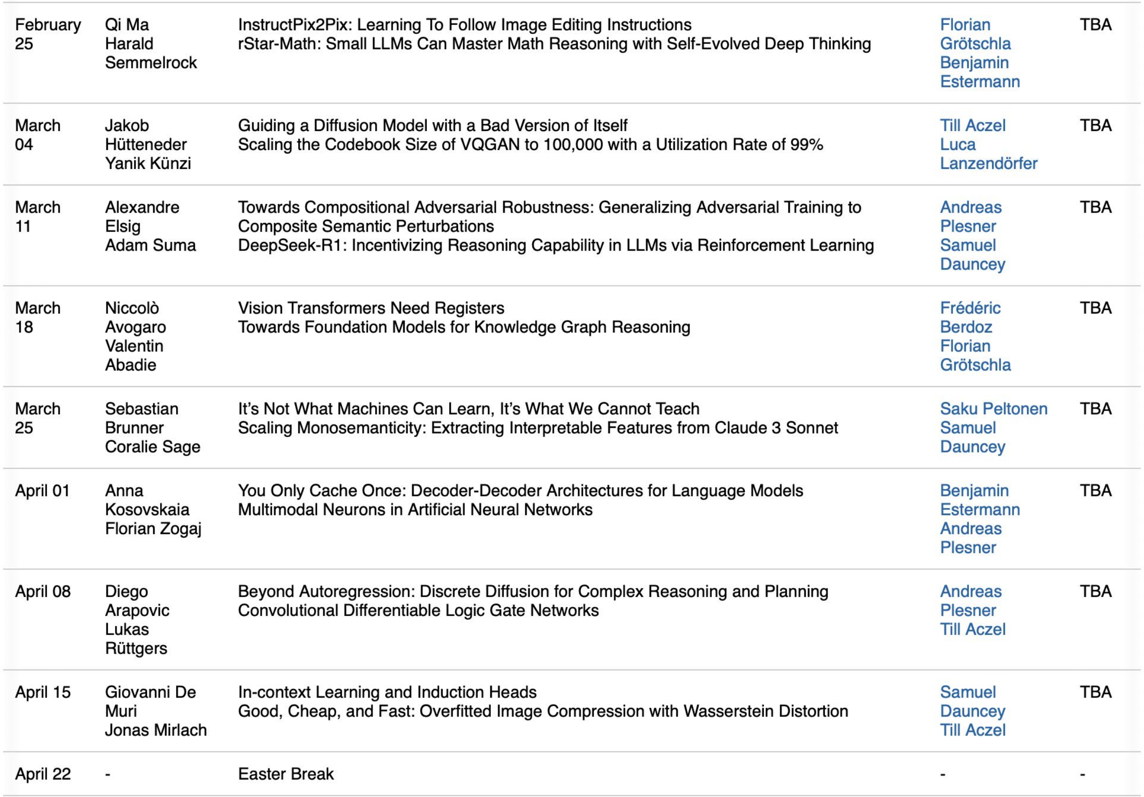
Saku

Sam

Topic overview



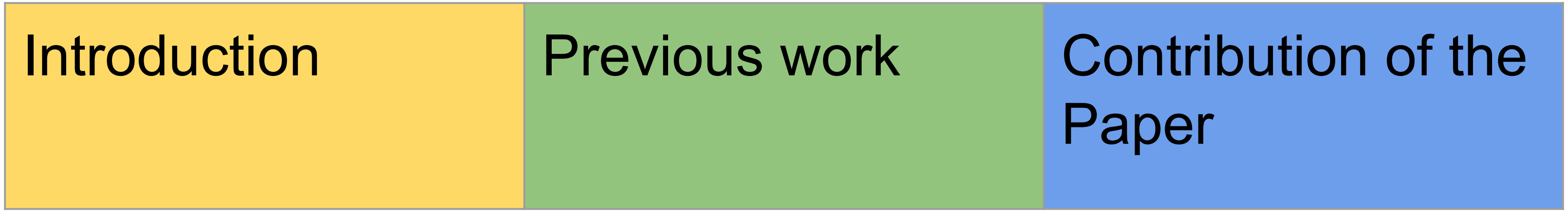
Schedule



February 25	Qi Ma Harald Semmelrock	InstructPix2Pix: Learning To Follow Image Editing Instructions rStar-Math: Small LLMs Can Master Math Reasoning with Self-Evolved Deep Thinking	Florian Grötschla Benjamin Estermann	TBA
March 04	Jakob Hütteneder Yanik Künzi	Guiding a Diffusion Model with a Bad Version of Itself Scaling the Codebook Size of VQGAN to 100,000 with a Utilization Rate of 99%	Till Aczel Luca Lanzendörfer	TBA
March 11	Alexandre Elsig Adam Suma	Towards Compositional Adversarial Robustness: Generalizing Adversarial Training to Composite Semantic Perturbations DeepSeek-R1: Incentivizing Reasoning Capability in LLMs via Reinforcement Learning	Andreas Plesner Samuel Dauncey	TBA
March 18	Niccolò Avogaro Valentin Abadie	Vision Transformers Need Registers Towards Foundation Models for Knowledge Graph Reasoning	Frédéric Berdoz Florian Grötschla	TBA
March 25	Sebastian Brunner Coralie Sage	It’s Not What Machines Can Learn, It’s What We Cannot Teach Scaling Monosemanticity: Extracting Interpretable Features from Claude 3 Sonnet	Saku Peltonen Samuel Dauncey	TBA
April 01	Anna Kosovskaia Florian Zogaj	You Only Cache Once: Decoder-Decoder Architectures for Language Models Multimodal Neurons in Artificial Neural Networks	Benjamin Estermann Andreas Plesner	TBA
April 08	Diego Arapovic Lukas Rüttgers	Beyond Autoregression: Discrete Diffusion for Complex Reasoning and Planning Convolutional Differentiable Logic Gate Networks	Andreas Plesner Till Aczel	TBA
April 15	Giovanni De Muri Jonas Mirlach	In-context Learning and Induction Heads Good, Cheap, and Fast: Overfitted Image Compression with Wasserstein Distortion	Samuel Dauncey Till Aczel	TBA
April 22	-	Easter Break	-	-

…

How to structure your talk



Introduction

Previous work

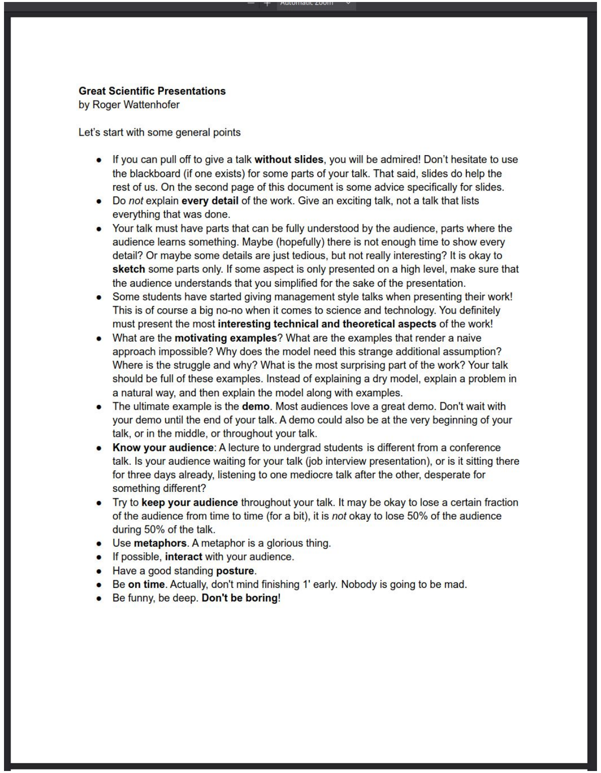
Contribution of the Paper

Why is this an interesting problem?

What has already been done to solve it?

What is newly proposed in this paper?

Presentation Style



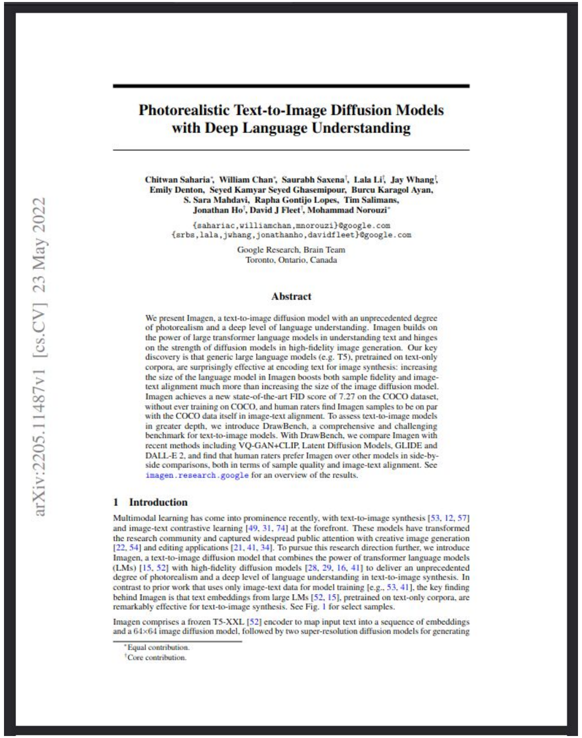
Great Scientific Presentations
by Roger Wattenhofer

Let's start with some general points

- If you can pull off to give a talk **without slides**, you will be admired! Don't hesitate to use the blackboard (if one exists) for some parts of your talk. That said, slides do help the rest of us. On the second page of this document is some advice specifically for slides.
- Do *not* explain **every detail** of the work. Give an exciting talk, not a talk that lists everything that was done.
- Your talk must have parts that can be fully understood by the audience, parts where the audience learns something. Maybe (hopefully) there is not enough time to show every detail? Or maybe some details are just tedious, but not really interesting? It is okay to **sketch** some parts only. If some aspect is only presented on a high level, make sure that the audience understands that you simplified for the sake of the presentation.
- Some students have started giving management style talks when presenting their work! This is of course a big no-no when it comes to science and technology. You definitely must present the most **interesting technical and theoretical aspects** of the work!
- What are the **motivating examples**? What are the examples that render a naive approach impossible? Why does the model need this strange additional assumption? Where is the struggle and why? What is the most surprising part of the work? Your talk should be full of these examples. Instead of explaining a dry model, explain a problem in a natural way, and then explain the model along with examples.
- The ultimate example is the **demo**. Most audiences love a great demo. Don't wait with your demo until the end of your talk. A demo could also be at the very beginning of your talk, or in the middle, or throughout your talk.
- **Know your audience**: A lecture to undergrad students is different from a conference talk. Is your audience waiting for your talk (job interview presentation), or is it sitting there for three days already, listening to one mediocre talk after the other, desperate for something different?
- Try to **keep your audience** throughout your talk. It may be okay to lose a certain fraction of the audience from time to time (for a bit), it is *not* okay to lose 50% of the audience during 50% of the talk.
- Use **metaphors**. A metaphor is a glorious thing.
- If possible, **interact** with your audience.
- Have a good standing **posture**.
- Be **on time**. Actually, don't mind finishing 1' early. Nobody is going to be mad.
- Be funny, be deep. **Don't be boring**!

https://disco.ethz.ch/courses/fs25/seminar/GreatScientificPresentations.pdf

How to approach your paper



Photorealistic Text-to-Image Diffusion Models with Deep Language Understanding

Chitwan Saharia*, William Chan*, Saurabh Saxena†, Lala Li†, Jay Whang†,
Emily Denton, Seyed Kamyar Seyed Ghasemipour, Burcu Karagol Ayan,
S. Sara Mahdavi, Rapha Gontijo Lopes, Tim Salimans,
Jonathan Ho†, David J Fleet†, Mohammad Norouzi*

{sahariac,williamchan,mnorouzi}@google.com
{srbs,lala,jwhang,jonathanho,davidfleet}@google.com

Google Research, Brain Team
Toronto, Ontario, Canada

Abstract

We present Imagen, a text-to-image diffusion model with an unprecedented degree of photorealism and a deep level of language understanding. Imagen builds on the power of large transformer language models in understanding text and hinges on the strength of diffusion models in high-fidelity image generation. Our key discovery is that generic large language models (e.g. T5), pretrained on text-only corpora, are surprisingly effective at encoding text for image synthesis: increasing the size of the language model in Imagen boosts both sample fidelity and image-text alignment much more than increasing the size of the image diffusion model. Imagen achieves a new state-of-the-art FID score of 7.27 on the COCO dataset, without ever training on COCO, and human raters find Imagen samples to be on par with the COCO data itself in image-text alignment. To assess text-to-image models in greater depth, we introduce DrawBench, a comprehensive and challenging benchmark for text-to-image models. With DrawBench, we compare Imagen with recent methods including VQ-GAN+CLIP, Latent Diffusion Models, GLIDE and DALL-E 2, and find that human raters prefer Imagen over other models in side-by-side comparisons, both in terms of sample quality and image-text alignment. See imagen.research.google for an overview of the results.

1 Introduction

Multimodal learning has come into prominence recently, with text-to-image synthesis [53, 12, 57] and image-text contrastive learning [49, 31, 74] at the forefront. These models have transformed the research community and captured widespread public attention with creative image generation [22, 54] and editing applications [21, 41, 34]. To pursue this research direction further, we introduce Imagen, a text-to-image diffusion model that combines the power of transformer language models (LMs) [15, 52] with high-fidelity diffusion models [28, 29, 16, 41] to deliver an unprecedented degree of photorealism and a deep level of language understanding in text-to-image synthesis. In contrast to prior work that uses only image-text data for model training [e.g., 53, 41], the key finding behind Imagen is that text embeddings from large LMs [52, 15], pretrained on text-only corpora, are remarkably effective for text-to-image synthesis. See Fig. 1 for select samples.

Imagen comprises a frozen T5-XXL [52] encoder to map input text into a sequence of embeddings and a 64×64 image diffusion model, followed by two super-resolution diffusion models for generating

[*] Equal contribution.
[†] Core contribution.

OpenReview.net

ICLR

NEURAL INFORMATION PROCESSING SYSTEMS

Admin stuff