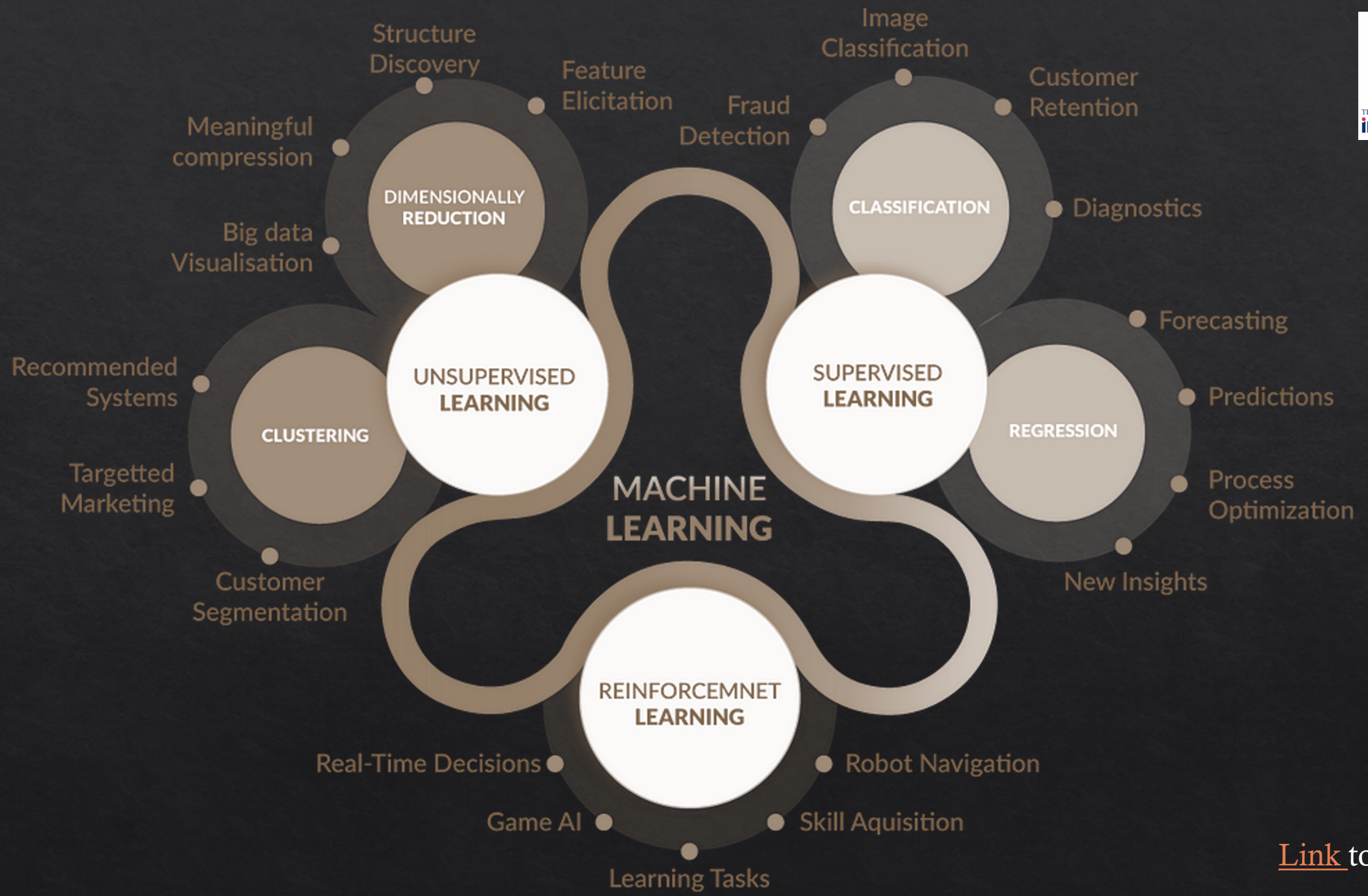


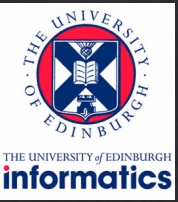
Computer Graphics

Lecture 17: Machine Learning for CG

Kartic Subr



Machine Learning in CG



Content generation

Simulation

Rendering

Content Generation

1. <https://visual.cs.brown.edu/workshops/aicc2021/>
2. <https://nvlabs.github.io/dl-for-content-creation/>
3. <https://www.youtube.com/watch?v=1kkFc9k9ho>
4. <https://dl.acm.org/doi/10.1145/3587423.3595503>

Simulation

<https://dl.acm.org/doi/10.1145/3587423.3595518>

https://geometry.cs.ucl.ac.uk/workshops/creativeai/slides/part6_physicsAnimation_nils.pdf



Rendering

1. Differentiable rendering
2. Neural rendering
3. Learning for faster MC rendering
 1. Denoising MC (also see this)
 2. DLSS
 3. Neural Radiance Fields



<https://history.siggraph.org/learning/differentiable-signed-distance-function-rendering-by-vicini-speierer-and-jakob/>

DLSS



- DLSS 1.0
 - upscale frames independently using DL
 - blurs on either side of an edge
- DLSS 2.0
 - Temporal Anti-Aliasing (TAA) problem with dynamic objects
 - Use DL to solve TAA history problem
 - Can oversharpen, causing ringing
- DLSS 3.0
 - Generates entire intermediate frames
 - could cause latency issues

NeRF (Neural Radiance Field)

1. <https://www.matthewtancik.com/nerf>
2. [SIGGRAPH 2023 course](#)

A Style-Based Generator Architecture for Generative Adversarial Networks

Tero Karras
NVIDIA

tkarras@nvidia.com

Samuli Laine
NVIDIA

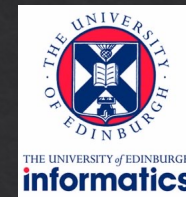
slaine@nvidia.com

Timo Aila
NVIDIA

taila@nvidia.com

StyleGAN

2017



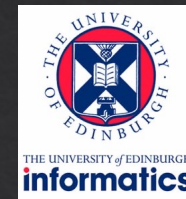
<https://www.kaggle.com/dunky11/stylegan>

Taming Transformers for High-Resolution Image Synthesis

Patrick Esser*, Robin Rombach*, Björn Ommer

CVPR 2021

VQGAN



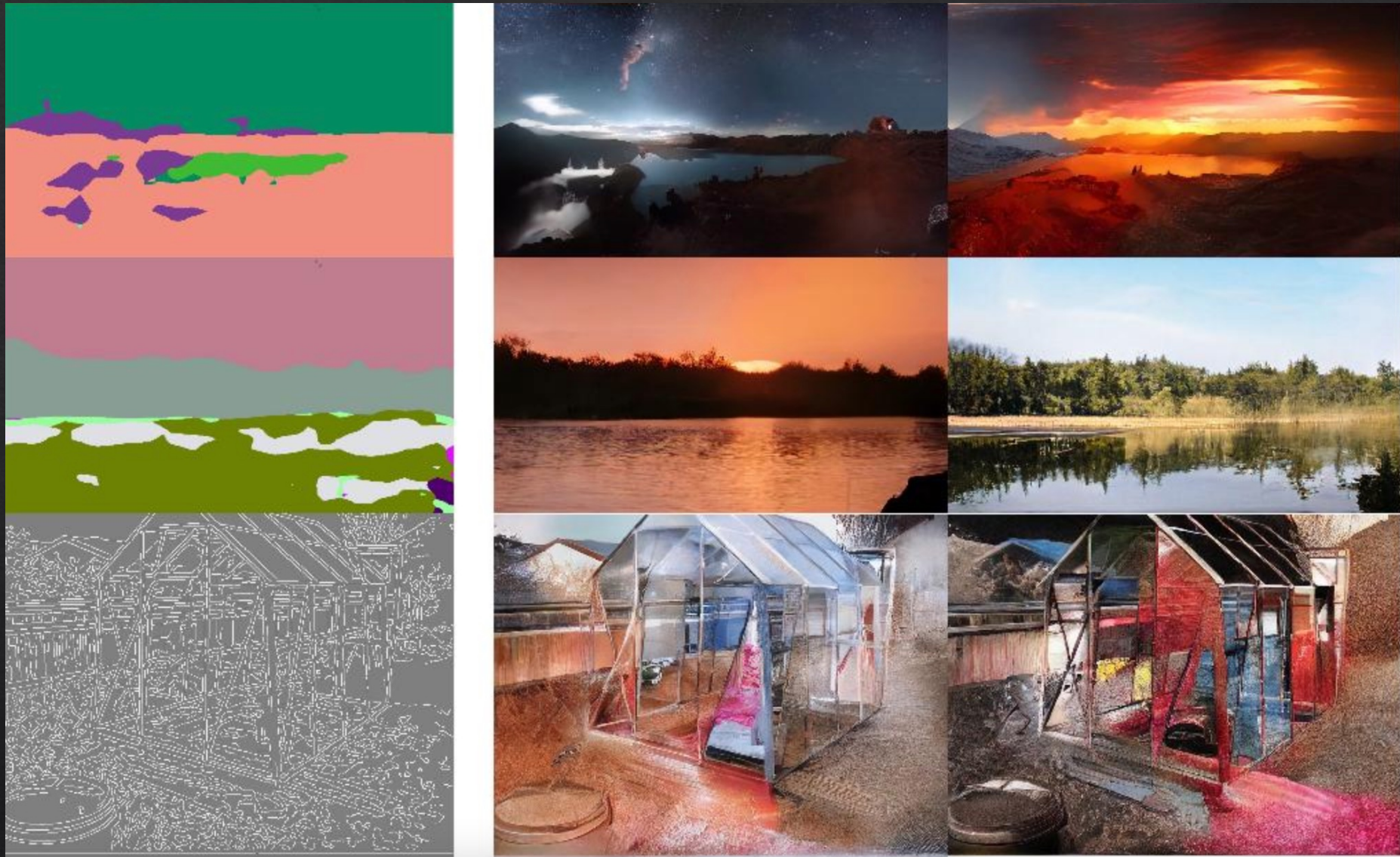
<https://github.com/CompVis/taming-transformers>

VQGAN: Text to image

Input: "A bird drawn by a child"



VQGAN: Conditional image synthesis



VQGAN: Conditional image synthesis




DiffRF: Rendering-guided 3D Radiance Field Diffusion


CVPR 2023 Highlight

Norman Müller^{1,2}, Yawar Siddiqui^{1,2}, Lorenzo Porzi², Samuel Rota Bulò², Peter Kotschieder²,
Matthias Nießner¹

¹Technical University of Munich, ²Meta Reality Labs

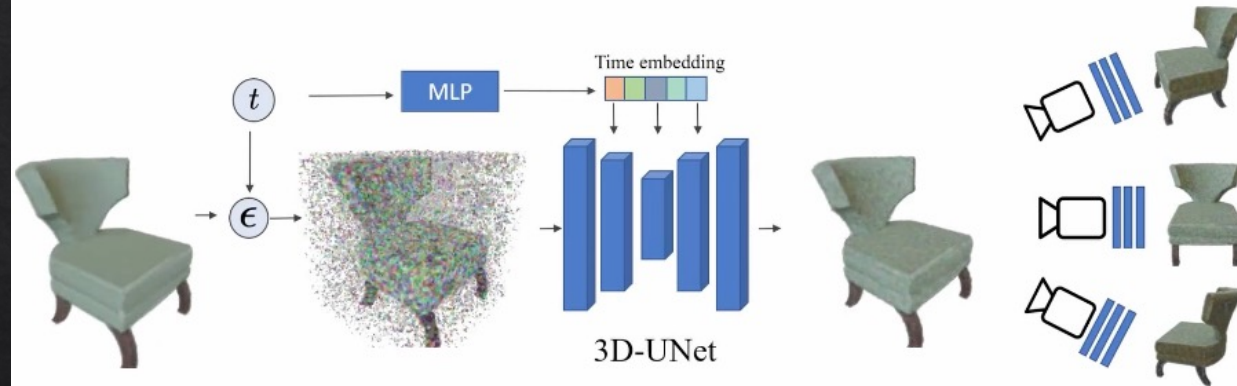
(Work was done during Norman's and Yawar's internships at Meta Reality Labs Zurich as well as at TUM.)

 Paper

 arXiv

 Video

(Version update, initial version contained a data mapping error causing all methods being trained/evaluated on a subset)



DIFFRF is a denoising diffusion probabilistic model directly operating on 3D radiance fields and trained with an additional volumetric rendering loss. This enables learning strong radiance priors with high rendering quality and accurate geometry.

CGR 2023

- Theory (20h)
 - 17h lectures
 - 3h reading
- Practice (78h)
 - 4h tutorials
 - 32h CW1
 - about 42h CW2

In this course

- Overview of CG (10%)
- Fundamentals (20%)
- Raytracing (20%)
- Offline rendering (20%)
- Realtime rendering (15%)
- Advanced (15%)

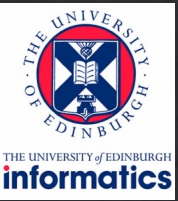
CGR2023

- Overview of CG (10%)
- Fundamentals (25%)
- Raytracing (20%)
- Offline rendering (20%)
- Realtime rendering (10%)
- Advanced (5%)

Lectures

#	Lecture Title
1	Introduction
2	Graphics tools
3	Imaging: radiometry and photometry
4	Cameras
5	Basic Modelling
6	Raytracing: introduction
7	Raytracing: advanced
8	Numerical integration
9	Monte Carlo
	----- No Lecture -----
10	C++ Programming with GPT and co-pilot
11	Presentations: CW1
12	Presentations: CW1
13	Light transport: path tracing
14	Sampling and reconstruction
15	Sampling II
16	Volume Scattering
17	Video lecture: Fast rendering pipelines I
18	Video lecture: Fast rendering pipelines II
19	Machine learning in rendering, conclusion and goodbyes

I would like your feedback on ...



- Why was tutorials attendance poor?
- More details vs more topics in lectures (depth vs breadth)?
- Suggestions for changes to syllabus/CW?

k.subr@ed.ac.uk

Feedback/nomination

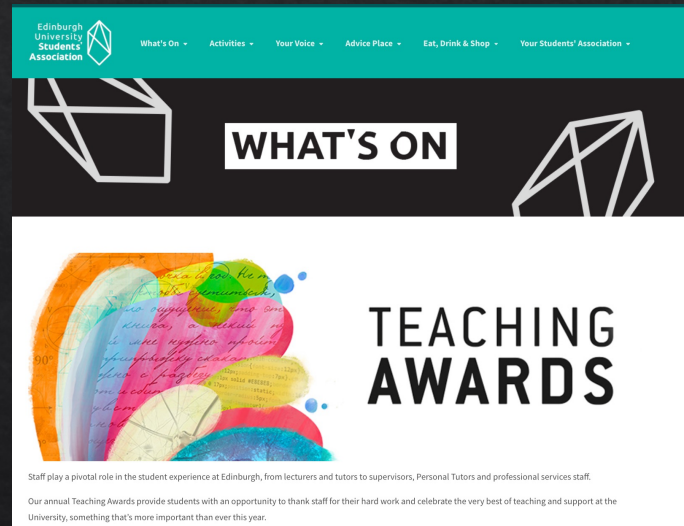
1) course survey

search for the link in your email or via learn

2) Nominate for award

teaching.awards@eusa.ed.ac.uk

Shortlisted in 2019/20 and 2021/22



Edinburgh University Students Association

What's On - Activities - Your Voice - Advice Place - Eat, Drink & Shop - Your Students' Association

WHAT'S ON

TEACHING AWARDS

Staff play a pivotal role in the student experience at Edinburgh, from lecturers and tutors to supervisors, Personal Tutors and professional services staff.

Our annual Teaching Awards provide students with an opportunity to thank staff for their hard work and celebrate the very best of teaching and support at the University, something that's more important than ever this year.



OUTSTANDING COURSE

We'd love to hear about courses which:

- Introduced you to a new topic or perspective, which shaped your academic journey
- Were delivered in ways which were engaging and made you excited to learn
- Helped you develop personally or professionally

OUTSTANDING INNOVATION IN DIGITAL TEACHING


We'd love to hear about staff who:

- Made excellent use of digital platforms to deliver teaching
- Utilised technology to engage students as active participants in their learning
- Created online spaces for students and staff to come together

SUPPORT STAFF OF THE YEAR

We'd love to hear about professional services staff who:

- Provided support during your student journey, whether in your School, accommodation site or a specialist service
- Helped things run smoothly and efficiently, making everyone's lives easier
- Pointed you in the right direction so that you could get the support you needed



Teacher of the Year

- **Shortlisted:** Iain Murray
- Cristina Alexandru
- Paul Anderson
- Stephen Gilmore
- Boris Grot
- Hugh Leather
- Ian Stark
- Kartic Subr
- Philip Wadler

Come back as a speaker in this course!

