Ryan Goldade

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Skills Summary

- **Languages**: C++, CUDA / Warp, Python / Pytorch
- **Research**: Physics-based simulation, differentiability (adjoint), neural emulators
- **Machine learning**: VAEs, autoregression, graph NNs, PINNs-based self-supervision
- **Mathematics**: Vector calculus, linear algebra, Newtonian mechanics, numerical PDEs, optimization

Experience

Meta Reality Labs Research
Research Scientist (2022-Present), Research Engineer (2020-2022) *May 2020 - Present*

Differentiable simulation: designed a differentiable simulation framework of an anatomically-inspired human model using finite elements and articulated bones. Integrated into optimization pipelines as a pytorch layer with a C++ backend and a GPU-based linear solver. Optimizing material parameters and joint locators using photometric losses improved temporal consistency for 4-D body and hand tracking for multiview stereo data (MVS).
Physics-based Avatar Rigs: designed a physics-based human avatar drivable with muscle-like active elastic materials, optimized using MVS capture data. Demonstrated technology at internal symposium by driving real-time virtual avatars with simulated activations to match facial expressions of capture performance and enable self-interactions like cheek rubbing.
Blendshape-based tracking: designed pipeline to transfer a template blendshape rig to human-subject MVS data through regularized optimization of shape and neutral states. Rig transfer improved 4-D tracking as a strong prior, enabled semantically-meaningful latent-space regularization for expression encoding space.
Neural-based physics: designed an efficient, neural-based, physical simulation pipeline for secondary dynamic effects for avatars. This autoregressive MLP model achieved long-run rollout stability with extreme performance (1-2 μs) on CPU, essential for compute-limited devices like VR headsets.

SideFX
Simulation Developer (part-time) *April 2016 - May 2020*

Simulation developer: designed and implemented features for Houdini's FLIP-based fluid simulator. Features ranged from tech transfers of own research, published research, and customer requests; developed in C++ with additional scripting in Python. Consisted mainly of efficient numerical solvers, parallel programming and sparse data structures to manage millions of voxels and billions of particles.
Highlighted features: surface tension, suction fluid, ocean simulation tools (16.0), narrow-band FLIP (16.5, 17.0, 17.5), air incompressibility (16.5), adaptive pressure projection (18.0), and adaptive viscosity (18.5)

Weta Digital
Simulation Intern *June 2018 - July 2018*

Tech transfer: Tech-transferred research from PhD to simulation R&D pipeline for underwater effects in Avatar 2.

IST Austria
Research Intern *February 2014 - May 2014*

Embedded liquid surfaces: improved on prior work for high-resolution liquid boundaries embedded in lower-resolution fluid simulations. Efficiently resolved visual artifacts created by this resolution mismatch and narrow-band level set representations of the liquid surface. Project published at Eurographics.

Microsoft
Research Intern *November 2012 - September 2013*

Fast fluids: designed a vortex-particle-based smoke simulation with passively advected front-tracking for smoke and fire rendering. Using robust GPU-based mesh reconstruction, we efficiently handled mesh topology changes at real-time rates. Project won *best poster* at Symposium on Computer Animation.

Education

University of Waterloo
Ph.D., Computer Science *2021*

Topics: fluid simulation, computer graphics, numerical PDEs
Awards: Alain Fournier Dissertation Award, Queen Elizabeth II Graduate Scholarship in Science & Technology

Simon Fraser University
M.A.Sc., Engineering Science *2014*

Simon Fraser University
B.A.Sc., Engineering Science *2009*

Publications

Publications at top-tier graphics conferences. See Google Scholar