Ivan Puhachov

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Last updated: June 2024

Publications & Projects

- Generative 2D Graphics with Diffusion — TBA
  Ivan Puhachov, Thibault Groueix, Noam Aigerman, Mikhail Bessmeltsev — [TBA]
  TLDR: Using Diffusion to generate expressive geometry-driven animation.
  Work in progress.

- Neural Implicit Reduced Fluid Simulation — Under Review
  Yuanyuan Tao, Ivan Puhachov, Derek Nowrouzezahrai, Paul Kry — [TBA]
  TLDR: Fluid simulation using latent space of implicit geometric model.
  Under review.

- Reconstruction of Machine-Made Shapes from Bitmap Sketches — SIGGRAPH Asia 2023
  Ivan Puhachov, Cedric Martens, Paul G. Kry, Mikhail Bessmeltsev — [project page][tbd]
  TLDR: 3D shape reconstruction from natural sketch by patch-based optimization
  Extracting geometric primitives with ML then aligning them to the drawing.

- Stability-Aware Simplification of Curve Networks — SIGGRAPH 2022
  William Neveu, Ivan Puhachov, Bernard Thomaszewski, Mikhail Bessmeltsev — [project page][acm]
  TLDR: design a curve network on a shape by worst-case stability criterion.
  Simplified mixed-integer semi-definite programming to an efficient greedy algorithm.

- Keypoint-Driven Line Drawing Vectorization via PolyVector Flow — SIGGRAPH Asia 2021
  Ivan Puhachov, William Neveu, Edward Chien, Mikhail Bessmeltsev — [project page] [acm]
  TLDR: novel PolyVector flow aligns curve to a smooth cross-field over bitmap image.
  ML keypoint detection and optimization to extract vector curves from raster data.

Experience

- **Research Engineering Intern** at Huawei, Canada — Montreal, Canada, Oct 2021 - Feb 2024
  - First-author publication in SIGGRAPH Asia 2023
  - Participated in fluid simulation project [under review]
  - Developed product demo for mesh deformation, skinning and rigging, machine learning shape deformation.

- **Machine Learning Research Intern** at MobiDev — Kharkiv, Ukraine, Feb 2019 - Aug 2019
  Computer Vision user verification; fine-tuning verification system; QA pipeline

Skills Summary

Programming Languages: Python, C++, bash
Frameworks: PyTorch, JAX, NumPy, SciPy, CGAL, libigl, Eigen, pyomo, Ipopt,
Tools: git, docker, Blender, Blender scripting, Adobe Illustrator scripting
Geometry and Graphics: differential geometry; shape analysis; mesh optimization; deformation and animation; vector fields; optimization algorithms
Machine Learning: data processing; clustering; computer vision – detection, classification, segmentation; feature extraction and fine-tuning; generative models – GAN, VAE; neural implicit models – deepSDF, NeRF;

Education

- Université de Montréal — Montreal, Canada, Sept 2019 - 2024 (expected)
  PhD in Computer Science, DIRO, LIGUM
  Research supervisor: Mikhail Bessmeltsev

- University of L'Aquila & Kharkiv National University — L'Aquila, Italy, Sept 2017 - June 2019
  MSc (cum laude) in Mathematical Engineering; GPA: 3.93 / 4.0
  Joint MSc Programme Intermaths
  Thesis: "Catacaustics of surfaces" (advisor: Alexander L. Yampolsky)

- V.N. Karazin Kharkiv National University — Kharkiv, Ukraine, Sept 2013 - June 2017
  BSc in Mathematics, School of Mathematics and Informatics, Geometry; GPA 3.66 / 4.0

Activities

- **Teaching Assistant, IFT 6113** *"Geometric Modeling and Shape Analysis"* Fall 2022, 2021, 2020
  Homework code templates, assessment, face-to-face evaluation, tech support, forum moderation `[course page]`

- **Project IFT 6756** *"Game Theory and Machine Learning"* Spring 2021
  Trained generative models (GAN, WGAN, SNGAN) for vector images `[project page]`

- **Project IFT 6010** *"Modern Natural Language Processing"* Spring 2021
  RNN with Attention to generate vector drawings `[project page]`

- **Project IFT 6113** *Geometric Modeling and Shape Analysis* Fall 2019
  2D shape analysis; discrete geometry and PDE solver; functional mapping `[website]`