Ivan Puhachov

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I am a PhD-student working on geometry processing, optimization and machine learning with applications to natural drawings and sketches.

Publications

- **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** — Montreal, Canada
  Quantum Technology Recruiting Inc. on assignment with Huawei Canada — Oct 2021 - Present
  - **Research, part-time internship**: Successful submission to SIGGRAPH Asia
    In collaboration with Prof. Mikhail Bessmeltsev and Prof. Paul G. Kry
- **Machine Learning Research Intern** — Kharkiv, Ukraine
  MobiDev — Feb 2019 - Aug 2019
  - **ID Verification system**: Image quality assesment system; fine-tuning verification system; QA pipeline
  - **Object detection**: Proof-of-Concept demo for multiple object detection

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
  PhD in Computer Science, DIRO, LIGUM — Sept 2019 - 2024 (expected)
  Research supervisor: Mikhail Bessmeltsev
- **University of L'Aquila & Kharkiv National University** — L'Aquila, Italy
  MSc (cum laude) in Mathematical Engineering; GPA: 3.93 / 4.0 — Sept 2017 - June 2019
  Joint MSc Programme Intermaths
  Thesis: "Catacaustics of surfaces" (advisor: Alexander L. Yampolsky)
- **V.N. Karazin Kharkiv National University** — Kharkiv, Ukraine
  BSc in Mathematics, School of Mathematics and Informatics, Geometry; GPA 3.66 / 4.0 — Sept 2013 - June 2017

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]