ALEKSEI PETRENKO

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https://github.com/alex-petrenko

EDUCATION & RESEARCH

2018-present, USA:

Computer science Ph.D. student at University of Southern California, funded by USC Provost Fellowship (current GPA 4.0/4.0)
Advisor: Prof. Gaurav Sukhatme, USC Robotic Embedded Systems Lab

Research interests: deep reinforcement learning, high-throughput RL, efficient ML systems, distributed RL, multi-agent learning and self-play, intrinsic motivation & exploration.
Recent coursework: reinforcement learning, statistical machine learning, advanced analysis of algorithms

2008-2012, Russia:

M. Sc. in Computer Science at Nizhny Novgorod State Technical University (5.0/5.0)
B. Sc. in Computer Science at Nizhny Novgorod State Technical University (4.95/5.0)

RECENT PUBLICATIONS

- Petrenko A., Huang Z., Kumar T., Sukhatme G., and Koltun V. Sample Factory: Egocentric 3D control from pixels at 100000 fps with asynchronous reinforcement learning. In ICML, 2020.
  Arxiv, Github, Website

SKILLSET

Programming languages:

- C++ (highly advanced). C++ is my favorite language for its speed, portability, and weird elegance. C++11/14/17, STL, Qt, CMake.
- Python (advanced). Experience includes research, prototyping and automation
- C#, Java, Javascript (extensive experience from industry, proficient with some catching up)

Skills:

- Software development and architecture. Creating complex software systems from ground up: mobile, desktop, server-side, VR, plugins, frameworks. Multithreading, optimization, patterns, data binding, loose coupling, APIs, UI, etc.
- Deep learning: CNNs, RNNs, ResNets, UNets, GANs, VAEs, etc.
  Deep reinforcement learning. Implemented and deployed many RL methods from scratch: DQN, Reinforce, A2C, PPO, APPO, IMPALA, etc.
  Frameworks & tools: PyTorch, Tensorflow, Ray, RLLib, OpenAI Gym, etc.
- Algorithms. Solid background from industry and programming competitions. Graph algorithms, computational complexity, data structures, etc.
- Computer vision, OpenCV, depth sensors & 3D data processing
- Cloud, scalable services, clusters (AWS API, Docker, Slurm)
- 3D rendering (OpenGL, Unity3D, Magnum) and VR (Oculus)

EMPLOYMENT HISTORY

PhD Research Intern at Intel Labs **Summer 2020, Los Angeles, USA**

Joined Vladlen Koltun and ISL once more to develop a new breed of high-throughput simulators for deep reinforcement learning. The project is being prepared for publication.
Technologies: C++17, Python, PyTorch, Vulkan, OpenGL

PhD Research Intern at Intel Labs **Summer 2019, Santa Clara, USA**

Advised by Vladlen Koltun, worked on a new asynchronous reinforcement learning system that can achieve up to 150000 FPS of training throughput on a single GPU. Using this new framework achieved new SOTA in VizDoom environments, including the challenging multi-agent and self-play scenarios. The project titled "Sample Factory" was presented at ICML 2020.

Technologies: Python, PyTorch, TensorFlow, RLLib, Ray, OpenAI Gym, Slurm

Tech Lead at itSeez3D **2015-2018, Nizhny Novgorod, Russia**

Lead algorithms and systems developer in the computer vision startup. My main project with itSeez3D was the AI-based human digitization engine called Avatar SDK.

- Developed a deep learning-based method for accurate 3D reconstruction of the human head from a single portrait photo
- R&D for the automatic generator of full-body characters (skeleton animation, rendering, deep learning)
- Optimized deep neural networks for deployment (quantization, compression, etc.)
- Worked on various applications for the avatar engine: mobile, desktop and virtual reality. Developed and deployed interactive demos for major conferences and exhibitions: SIGGRAPH, GDC, VRX.

My avatar automatically created from a single photo by the Avatar SDK demo app: https://skfb.ly/6FUYY

Key technologies:

- C++11/14 and OpenCV for the algorithms
- TensorFlow and Keras for deep learning
- Python for prototyping and scripting
- OpenGL, Unity & Unreal for 3D rendering, Oculus SDK + Unity for VR

Senior Software Engineer at itSeez **2013-2015, Nizhny Novgorod, Russia**

Computer vision startup and for many years a company behind the OpenCV library. At itSeez I was involved in the development of the first portable consumer 3D scanner.

- 3D scanning algorithms for various depth sensor platforms: Intel RealSense, Google Tango, Apple iPad + Occipital Structure Sensor, etc.
- Developed a cloud backend for the 3D reconstruction pipeline
- Created mobile and desktop 3D scanning applications
- Algorithms for polygonal mesh and point cloud processing, filtering and refinement of noisy 3D data, algorithms that prepare meshes for 3D printing: mesh "hollowisation" (polygon offset), ensuring manifoldness, etc.

My full-body scan made with itSeez3D software: https://skfb.ly/CzyX

Technologies: C++, OpenCV, C# & Xamarin, Python+numpy, Django, AWS, Docker

Software Engineer at Tecom **2010-2013, Nizhny Novgorod, Russia**

Developed a big real-time (frame perfect) massively parallel broadcast automation system with many levels of redundancy. Position in Tecom allowed me to acquire expertise in many areas of software engineering, from architecture to low-level optimization.

Technologies: C++ and Qt, C#, Java, Javascript, Python, Linux

SELECTED OPEN-SOURCE PROJECTS

- https://github.com/alex-petrenko/sample-factory the fastest (at the time of release) open-source on-policy RL implementation (see publications)
- https://github.com/alex-petrenko/faster-fifo faster alternative to built-in Python multiprocessing.Queue
- https://github.com/alex-petrenko/tf-reinforce Tensorflow implementation of classic policy gradient algorithms for continuous control tasks
- https://github.com/alex-petrenko/rl-experiments deep RL algorithms (Double DQN, A2C) in the context of the gridworld environment called MicroTbs
- https://github.com/alex-petrenko/4dvideo volumetric video recorder and player for Intel RealSense and Google Tango. It can capture and playback "4D" clips like this in real time with a single mobile device. Features a very fast Delaunay triangulation algorithm based on modified Guibas-Stolfi method

ACHIEVEMENTS

- Provost PhD Fellowship from University of Southern California (2018)
- Scholarship of the President of the Russian Federation (2012)
- 1st place at "Osipovsky Cup 2012" programming contest held in Kovrov State Technological Academy
- Winner of the Code Game Challenge at ACM ICPC Southern Subregional Contest (2012)
- Participant of the ACM ICPC, World Semifinals (NEERC, 2012)
- Prize winner of the ACM ICPC, World Quarterfinals (NEERC Southern Subregional, 2010-2012)

OTHER INTERESTS

- Futurology, transhumanism, AGI, singularity. Authors: E. Yudkowsky, G. Egan, R. Kurzweil, K. Eric Drexler, V. Vinge
- Fundamental science: physics, cosmology, evolutionary biology
- Entrepreneurship
- Hobbies: motor racing, karting