Dr Egor Sedov

Researcher | Machine Learning & Software Engineer | AI Consultant

Luxembourg

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Experienced **Researcher & Software Engineer** with a strong background in **full-cycle software development**, including design, coding, testing, and deployment. Skilled in **machine learning**, coding, and a deep understanding of **math** and **physics**. Committed to being a part of the team driving new discoveries and **creating innovative technology solutions** to shape a better world.

WORK EXPERIENCE

Team Lead, Metrology Department | Industrial 3D Scanning Manufacturer | Luxembourg 06/2024 - present

- Led the Metrology Department's **verification and certification programme** for production 3D scanners, ensuring results were **standards-driven, traceable, and audit-ready** (VDI/VDE 2634-3; ISO/IEC 17025).
- Built and maintained the internal **metrology software/tooling stack** (C++/Python), including automated processing, test parametrisation, and certificate/report generation pipelines.
- Led cross-functional **root-cause investigations of accuracy regressions**, running hypothesis-driven experiments (recalibration targets, focus/projection distance changes, optics prototypes) and converting results into engineering decisions.
- **Led the design** and execution of **Repeatability & Reproducibility** studies, covering experimental planning, automated data capture, statistical variance decomposition, and formal validation reporting.
- Developed and productised **point-cloud and geometric analysis tools** to accelerate investigations and improve measurement robustness.
- Acted as a "full-stack metrology" owner: designed and iterated **physical fixtures and experimental setups**, operated automated capture (robots/stands), analysed results, and defended conformance through documented procedures.
- Provided day-to-day engineering leadership: **planning/refinement, PR reviews, mentoring, and QMS documentation**, keeping critical workstreams moving during key-stakeholder absence.

Independent AI / ML Consultant (Part-time) 05/2024 - present

- **Designed** and **orchestrated** automated AI pipelines using LangChain, LlamaIndex, n8n, and FastAPI, integrating LLM-based systems into business processes and engineering workflows, including CI/CD automation.
- **Architected multi-agent systems** with structured role decomposition (planner / executor / critic), implementing **Retrieval-Augmented Generation** (RAG) and integrating external APIs, CRM, ERP, and enterprise systems.
- Developed **AI-augmented SDLC** pipelines embedding LLM-based agents into code review, specification drafting, automated testing, documentation generation, and refactoring workflows.
- Built **agent-driven internal tooling** for PR review, architectural validation, and structured spec-to-implementation pipelines.
- Delivered applied **machine learning** solutions in **computer vision** and **audio processing**, including segmentation, feature extraction, classification, detection, and environment-adaptive Voice Activity Detection (VAD).
- Developed **LLM-powered assistants** (Telegram, WhatsApp) and enterprise knowledge systems, implementing scalable RAG architectures and prompt engineering across multiple open-source and proprietary models.
- Customised and **fine-tuned neural networks** and **ML algorithms** for applied use cases across diverse domains.

Principal ML Engineer | Confidential XR/AI Startup (Remote) 10/2023 - 05/2024

- **Designed and built the complete AI and voice interaction pipeline** for real-time NPC systems in immersive VR environments, delivering low-latency (<500 ms) conversational performance.
- Architected and implemented distributed backend infrastructure, including adaptive **Voice Activity Detection** (VAD), **LLM-based dialogue orchestration**, and procedural quest generation engines.
- **Owned** model selection, orchestration logic, latency optimisation, and full-stack deployment strategy.
- Delivered **end-to-end production AI infrastructure** spanning model layer, retrieval systems, backend services, and cloud deployment.

Researcher & Software Engineer | Aston Institute of Photonic Technologies | Birmingham, UK 10/2020 - 05/2024

- **Developed a high-speed software library** for simulating light signal transmissions, capable of boosting process **speeds up to 2000 times**. This publicly accessible tool on Github has substantial potential to **accelerate research** in optical communication systems
- Built a **high-capacity data platform** for light-based communication technologies, currently powering several key **machine learning** projects with over a **1 000 000 data points per minute**
- Developed a versatile **machine learning platform** incorporating a variety of techniques. This platform **doubled** the efficiency of long-distance, light-based data transmission, **significantly reducing data losse**s and **enhancing** system **performance**
- Played a **crucial role** in pioneering **research**, aiding in the development of a **novel software model** for improving light-based communication. This work holds the potential to significantly **enhance the efficiency** of future communication projects
- **Actively guided** several **Master's students** through their innovative research projects, providing critical support and mentorship that significantly contributed to their academic growth in the field of optical communication
- Delivered **100+ hours** of practical classes in Digital Signal Processing, Python, and Mathematics for Bachelor students

Visiting Researcher & Software Engineer (Collaboration) | Huawei | Moscow, Russia 02/2021 - 05/2023

- **Developed** a cutting-edge **data processing platform** from scratch using Python, leveraging optimized **C++** libraries for an astounding 60-fold boost in computation speed, **reducing** the computational time **from weeks to hours**, increasing productivity
- **Developed and validated physics-informed signal processing and machine learning methods** to enhance data transmission over distances up to 2000km, leading to a potential increase in network capacity. This innovation has yielded up to a **10-fold performance increase** in certain systems
- **Optimized the software implementation process**, ensuring a more organized approach to data and code management. This improvement has led to a significant decrease in software deployment time

Researcher & Software Engineer | Nonlinear Photonics Laboratory | Novosibirsk, Russia 09/2016 - 05/2022

- **Led a team of 6 scientists and** software **engineers** in a successful 2-year collaborative project with a prominent corporate partner
- **Developed a cutting-edge software** solution for analyzing complex data in long-distance communication systems, leading to an impressive **125% improvement** in system performance
- **Developed advanced methods** for analysing optical channel dynamics, achieving a **3x increase in computational efficiency** and up to **4x improvement in reconstruction accuracy** over previous techniques.
- **Undertook thorough research** on advanced optical signal characteristics, resulting in two influential **publications** and presentations at **five major industry conferences**

Teaching assistant (part-time) | Novosibirsk State University | Novosibirsk, Russia 08/2019 - 07/2020

- Practical classes in Mathematical Analysis and Computational Physics for Bachelor students, which resulted in a **100% pass rate** for the students I taught

Research Internship | Argon | Paris, France 11/2018 - 02/2019

- Created a machine learning algorithm using **Reinforced Learning** to **improve supply chain** performance in a simulation, demonstrating how AI can be more effective than traditional methods
- **Built a user-friendly web platform** where users can see the machine learning algorithm in action, making it clear how AI optimization can enhance their supply chain operations

Research Internship | Deutsches Elektronen-Synchrotron DESY | Hamburg, Germany 06/2016 - 09/2016

- **Developed multidimensional parameter optimisation** methods for Central Drift Chamber calibration in the Belle II experiment, significantly improving track reconstruction accuracy and measurement resolution.
- **Used advanced statistical methods** to optimize the performance of key project equipment, improving its accuracy and reliability

Research Internship | Budker Institute of Nuclear Physics | Novosibirsk, Russia 07/2013 - 08/2016

- **Carried out a study** to determine the robustness of scintillation materials used in **high-tech detection devices**, contributing to the overall reliability of the equipment
- **Created a comprehensive, automated measurement setup**, significantly improving the efficiency of data collection and analysis

SKILLS

Software Development Skills: C | C++ | Python | Docker | Git | Linux | Distributed systems | HPC (CUDA, OpenMP, MPI) | CI/CD | Code review | Agile | Data structures & algorithms | Full SDLC

Machine Learning & AI: PyTorch | TensorFlow | JAX | Scikit-learn | LLM systems | Retrieval-Augmented Generation (RAG) | Multi-agent architectures | Computer vision | Audio processing | Mathematical modelling | Numerical methods | Physics simulations | Linear algebra | SQL | Big data

AI Tooling & Orchestration: LangChain | LlamaIndex | FastAPI | n8n | LLM integration | Prompt engineering | AI-augmented SDLC | Claude | Cursor

Other Software and Hardware: 3D scanning | 3D printing | CATIA | SolidWorks | Mechanical prototyping | Machine diagnostics & service

Soft Skills: Communication | Teamwork | Leadership | Project Management | Mentoring | Time Management | Adaptability

Languages: English (Fluent) | Russian (Native) | French (Working proficiency)

EDUCATION

Aston University, UK
PhD, Machine Learning in Optical communication

Novosibirsk State University, Russia
PhD, Advanced Theory of optical communication (incomplete)

École des Ponts ParisTech, France
Engineering degree, Mechanical Engineering and Materials Science

Novosibirsk State University, Russia
- Master with Honours, Quantum Optics
- Bachelor with Honours, High Energy Physics

AWARDS

Scholarship for Abroad Studies | Ministry of Science and Higher Education of the Russian Federation 24/06/2021

Scholarship for Abroad Studies | Ministry of Science and Higher Education of the Russian Federation 04/08/2020

Hackaton Winner | TensorHack 19/04/2019

Scholarship | Erasmus+ 05/08/2018

Scholarship | French Government 24/08/2017

Scholarship | BP 30/05/2015

Scholarship | BP 22/10/2014

Scholarship | PricewaterhouseCoopers 21/11/2013

INTERESTS

Drone pilot | Snowboard | Traveling

REFERENCES

Prof Sergei Turitsyn s.k.turitsyn@aston.ac.uk
Director | Aston Institute Of Photonic Technologies

Prof David Saad d.saad@aston.ac.uk
Professor | Aston Centre for Artificial Intelligence Research and Application

PUBLICATIONS

1. I.S. Chekhovskoy, O.V. Shtyrina, M.P. Fedoruk, **E.V. Sedov**, S.K. Turitsyn, “Application of the nonlinear Fourier transform for analysis of the coherent structures generation”, Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC), 2025.
2. **Egor Sedov**, Igor Chekhovskoy, Mikhail Fedoruk, Sergey Turitsyn, “Numerical Approaches in Nonlinear Fourier Transform-Based Signal Processing for Telecommunications”, Studies in Applied Mathematics, 2025.
3. I.S. Chekhovskoy, **E.V. Sedov**, G.A. Patrin, O.V. Shtyrina, “Continuous dual-polarization signal processing using windowed Nonlinear Fourier Transform”, International Conference Laser Optics (ICLO), 2024.
4. **Egor Sedov**, Igor Chekhovskoy, “Next-generation signal processing using windowed nonlinear Fourier transform”, Nonlinear Optics and its Applications, 2024.
5. **Egor Sedov**, Felippe Alves Pereira, David Saad, Sergei Turitsyn , “Examining nonlinear behaviors in optical communication systems using Gaussian mixture model”, Nonlinear Optics and its Applications, 2024.
6. I.S. Chekhovskoy, **E.V. Sedov**, S.K. Turitsyn, M.P. Fedoruk, “Application of the Nonlinear Fourier Transform in Optical Telecommunications,” 11th International Workshop on Fibre Lasers, Proceedings, Novosibirsk, 2024.
7. **Egor Sedov** and Igor Chekhovskoy "Next-generation signal processing using windowed nonlinear Fourier transform", Proc. SPIE 13004, Nonlinear Optics and its Applications 2024, 130040Z (20 June 2024);
8. **E. Sedov,** PhD Thesis, Aston University 2023
   MACHINE LEARNING FOR PERFORMANCE IMPROVEMENT OF LONG-HAUL END-TO-END OPTICAL TRANSMISSION SYSTEMS
9. D.I. Kachulin, I.S. Chekhovskoy, S.B. Medvedev, **E.V. Sedov**, I.A. Vaseva, M.P. Fedoruk, “Fourth-Order Accurate Schemes for Solving the Direct Scattering Problem for the Manakov System,” All-Russian Conference on Fibre Optics (VKVO), Perm, 2023.
10. I.S. Chekhovskoy, **E.V. Sedov**, O.V. Shtyrina, “Windowed Signal Processing Method Using the Nonlinear Fourier Transform,” All-Russian Conference on Fibre Optics (VKVO), Perm, 2023.
11. I.S. Chekhovskoy, **E.V. Sedov**, I.A. Vaseva, D.I. Kachulin, S.B. Medvedev, M.P. Fedoruk, S.K. Turitsyn, “Fibre-Optic Communications Using the Nonlinear Fourier Transform,” All-Russian Conference on Fibre Optics (VKVO), Perm, 2023.
12. Bogdanov, S., Shepelsky, D., Vasylchenkova, A., **Sedov, E**., Freire, P.J., Turitsyn, S.K. and Prilepsky, J.E., 2023. Phase computation for the finite-genus solutions to the focusing nonlinear Schrödinger equation using convolutional neural networks. *Communications in Nonlinear Science and Numerical Simulation*, **125**, p.107311.
13. Srivallapanondh, S., Freire, P.J., Alam, A., Costa, N., Spinnler, B., Napoli, A., **Sedov, E**., Turitsyn, S.K. and Prilepsky, J.E., 2023. Multi-Task Learning to Enhance Generazability of Neural Network Equalizers in Coherent Optical Systems. *arXiv preprint arXiv:2307.05374.*
14. **Sedov, E**., 2023, June. Gradient Boosting for Nonlinear Equalization in Optical Transmission Systems. In *2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)* (pp. 1-1). IEEE.
15. Reznichenko, A.V., Chernykh, A.I., **Sedov, E.V**. and Terekhov, I.S., 2022. Optimal input signal distribution for a nonlinear optical fiber channel with small Kerr nonlinearity. *JOSA B*, **39**(3), pp.810-820.
16. **Sedov, E.V.**, Chekhovskoy, I.S. and Prilepsky, J.E.E., 2021. Neural network for calculating direct and inverse nonlinear Fourier transform. *Quantum Electronics*, **51**(12), p.1118.
17. **Sedov, E.V**., Freire, P.J., Seredin, V.V., Kolbasin, V.A., Kamalian-Kopae, M., Chekhovskoy, I.S., Turitsyn, S.K. and Prilepsky, J.E., 2021. Neural networks for computing and denoising the continuous nonlinear Fourier spectrum in focusing nonlinear Schrödinger equation. *Scientific Reports*, **11**(1), p.22857.
18. **Sedov, E**., Freire, P.J., Chekhovskoy, I., Turitsyn, S. and Prilepsky, J., 2021, September. Neural Networks For Nonlinear Fourier Spectrum Computation. In *2021 European Conference on Optical Communication (ECOC)* (pp. 1-4). IEEE.
19. **Sedov, E**., Prilepsky, J., Chekhovskoy, I. and Turitsyn, S., 2021, June. Computing continuous nonlinear Fourier spectrum of optical signal with artificial neural networks. In *European Quantum Electronics Conference* (p. ej_1_4). Optica Publishing Group.

20. Chekhovskoy, I.S., Medvedev, S.B., Vaseva, I.A., **Sedov, E.V.** and Fedoruk, M.P., 2021, June. Fast Eigenvalue Evaluation of the Direct Zakharov-Shabat Problem in Telecommunication Signals Using Adaptive Phase Jump Tracking. In *The European Conference on Lasers and Electro-Optics* (p. ci_p_2). Optica Publishing Group.
21. Chekhovskoy, I., Medvedev, S.B., Vaseva, I.A., **Sedov, E.V.** and Fedoruk, M.P., 2021. Introducing phase jump tracking-a fast method for eigenvalue evaluation of the direct Zakharov-Shabat problem. *Communications in Nonlinear Science and Numerical Simulation*, **96**, p.105718.
22. **Sedov, E.V.**, Chekhovskoy, I.S., Prilepsky, J.E.E. and Fedoruk, M.P., 2020. Application of neural networks to determine the discrete spectrum of the direct Zakharov–Shabat problem. *Quantum Electronics*, **50**(12), p.1105.
23. **Sedov, E.V.**, Redyuk, A.A., Fedoruk, M.P. and Turitsyn, S.K., 2020, November. Statistical occurrence of soliton content in the conventional optical WDM signals. In *2020 International Conference Laser Optics (ICLO)* (pp. 1-1). IEEE.
24. Turitsyn, S., **Sedov, E.**, Redyuk, A. and Fedoruk, M., 2019. Nonlinear spectrum of conventional OFDM and WDM return-to-zero signals in nonlinear channel. *Journal of Lightwave Technology*, **38**(2), pp.352-358.
25. **Sedov, E.V.**, Redyuk, A.A., Fedoruk, M.P., Gelash, A.A., Frumin, L.L. and Turitsyn, S.K., 2018. Soliton content in the standard optical OFDM signal. *Optics Letters*, **43**(24), pp.5985-5988.
26. Chakin, I., Golkovksy, M., Kuzmin, A., Matvienko, D., **Sedov, E.** and Shwartz, B., 2017. Radiation hardness study of CsI (Tl) scintillation crystals for the Belle II calorimeter. *Journal of Instrumentation*, **12**(06), p.C06034.

TALKS AND PRESENTATIONS

1. Nonlinear Fourier Transform for Continuous Signal Processing: Novel Windowing Approach. November 13, 2023. Conference talk, *IEEE Photonics Conference (IPC)*, Orlando, Florida, USA
2. Real-Time Demonstration of Optical Communication System Performance Using HpCom Numerical Simulator. October 3, 2023. Demo presentation, *European Conference on Optical Communication (ECOC)*, Glasgow, UK
3. Forest Equalization for Coherent Optical Transmission Systems. February 14, 2023. Poster presentation, *Telecommunications, Optics and Photonics (TOP)* Conference, London, UK
4. Neural Network for Direct and Inverse Nonlinear Fourier Transform. February 14, 2022. Poster presentation, *Telecommunications, Optics and Photonics (TOP)* Conference, London, UK
5. Neural Networks For Nonlinear Fourier Spectrum Computation. September 01, 2021. Conference talk, *European Conference on Optical Communication (ECOC),* Bordeaux, France
6. Computing continuous nonlinear Fourier spectrum of optical signal with artificial neural networks. August 01, 2021. Conference talk, *SPIE Optics + Photonics | Applications of Machine Learning 2021*, San Diego, USA
7. Gradient Boosting for Nonlinear Equalization in Optical Transmission Systems. June 21, 2021. Conference talk, *CLEO/Europe-EQEC 2023*, Munich, Germany
8. Computing Continuous Nonlinear Fourier Spectrum of Optical Signal with Artificial Neural Networks. June 21, 2021. Conference talk, *CLEO/Europe-EQEC 2021*, Munich, Germany