Kaspar Sakmann

(D.Sc.)

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Work experience

Jan 2018 – current **Research Engineer**, *Bosch Center for Artificial Intelligence, Stuttgart, Germany*

- Anomaly segmentation: built a synthesized outlier pipeline and improved out-of distribution detection performance in an autonomous driving application.
- Developed an algorithm for certified defences against adversarial patch attacks in semantic segmentation. Paper accepted at ICLR '23.
- Applied domain adaptation to semantic segmentation for a customer: designed a pipeline for reusing data collected with previous camera generations. The older data was used as a data pool to improve performance on later generation cameras.
- Synthetic image synthesis for generating corner cases in autonomous driving scenarios. Using generative models (GANs, VAEs, Normalizing Flows), investigated the possibilities of generating novel street scenes with a focus on overall changes in lighting and weather conditions.
- Industry-side supervision of DeltaLab PhD students at the University of Amsterdam.

Nov 2016 – Nov 2017 **Big Data Architect**, *T-Mobile Austria, Vienna, Austria*

Developed location based services using mobile phone signals. In combination with the customer data built algorithms for the purpose of targeted advertising based on Apache Spark and Hadoop.

Apr 2015 – Oct 2016 **Postdoctoral Fellow**, *Technical University Vienna, Austria*

Development of parallel solvers for high-dimensional partial differential equations (many-body Schrödinger time dynamics). Supervision of master students.

Oct 2012 – Jan 2015 **Postdoctoral Research Fellowship Award**, *Stanford University, USA*

- Developed ancestral sampling for simulating ultracold quantum gases, published in *Nature Physics*.
- Designed a lightfield microscope 3D imaging of ultracold gases. Published in *Optics Letters*.

Aug 2010 – Sep 2012 **Postdoc**, *University of Heidelberg, Germany*, Parallelization of PDE and SDE solvers using OpenMP and MPI (running at the High-Performance Computing Center Stuttgart).

Software

Python pytorch, tensorflow, numpy, pandas, pytest, scikit-learn

Dev OPs git, poetry, conda, SLURM, GitHub Actions, Jenkins, bash, JIRA

C,C++ developed solvers for stochastic differential equations)

Education

2007 – 2010 **Doctor of Sciences (Physics)**, *University of Heidelberg*, magna cum laude, Algorithm development for quantum many-body dynamics for Bose-Einstein condensates, supervision of students

1997 – 2004 **Physik Diplom**, *University of Heidelberg, Germany and UNSW, Australia*, grade: excellent

Other

Languages German, English, French

Awards Karel Urbanek Postdoctoral Research Award, Stanford University (2012), Springer Theses Award, Recognizing Outstanding PhD Research (2011), Dr. Sophie-Bernthsen prize, University of Heidelberg (2008)

Conferences

[1] M. Yatsura, K. Sakmann, N. G. Hua, M. Hein, and J. H. Metzen. Certified defences against adversarial patch attacks on image segmentation (accepted). *International Conference on Learning Represenatations (ICLR)*, 2023.

Patents – Patent Applications

[2] D. Nielsen, E. Hoogeboom, K. Sakmann, M. Welling, and P. Jaini. Image classifier comprising a non-injective transformation. *US Patent Application US20220012549A1, European Patent Office Application EP3933692A4, South Korean Patent Application KR20220004933A, Chinese Patent Application CN113963227A, Japanese Patent Application JP2022013919A.*, 2022.

[3] K. Sakmann. Apparatus and method for image processing. *German Patent Office Application, DE102020205541A1*, 2020.

[4] V. Fischer, K. Rambach, C. K. Mummadi, A. Khoreva, K. Sakmann, and S. Piyapat. Object classification with content and location sensitive classifiers. *European Patent Application EP3910552A4, US Patent Application US20210357750A1, Chinese Patent Application CN113673709*, 2020.

[5] A. Khoreva and K. Sakmann. Device and method for training a generative model. *European Patent Office Application, EP3767590A1*, 2019.

Journal Publications

[6] K. Sakmann and M. Kasevich. Single-shot simulations of dynamic quantum many-body systems. *Nature Physics*, 12(5):451–454, 2016. Letter.

[7] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Universality of fragmentation in the Schrödinger dynamics of bosonic Josephson junctions. *Physical Review A*, 89:023602, 2014.

[8] K. Sakmann and M. Kasevich. Single-shot three-dimensional imaging of dilute atomic clouds. *Optics Letters*, 39(18):5317–5320, 2014.

[9] J. Grond, A. I. Streltsov, A. U. J. Lode, K. Sakmann, L. S. Cederbaum, and O. E. Alon. Excitation spectra of many-body systems by linear response: General theory and applications to trapped condensates. *Physical Review A*, 88:023606, 2013.

[10] A. U. J. Lode, K. Sakmann, O. E. Alon, L. S. Cederbaum, and A. I. Streltsov. Numerically exact quantum dynamics of bosons with time-dependent interactions of harmonic type. *Physical Review A*, 86:063606, 2012.

[11] A. U. Lode, A. I. Streltsov, K. Sakmann, O. E. Alon, and L. S. Cederbaum. How an interacting many-body system tunnels through a potential barrier to open space. *Proceedings of the National Academy of Sciences*, 2012.

[12] A. Deuchert, K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Dynamics and symmetries of a repulsively bound atom pair in an infinite optical lattice. *Physical Review A*, 86:013618, 2012.

[13] O. E. Alon, A. I. Streltsov, K. Sakmann, A. U. Lode, J. Grond, and L. S. Cederbaum. Recursive formulation of the multiconfigurational time-dependent Hartree method for fermions, bosons and mixtures thereof in terms of one-body density operators. *Chemical Physics*, 401(0):2, 2012.

[14] A. I. Streltsov, K. Sakmann, O. E. Alon, and L. S. Cederbaum. Accurate multi-boson long-time dynamics in triple-well periodic traps. *Physical Review A*, 83(4):043604, 2011.

[15] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Optimal time-dependent lattice models for nonequilibrium dynamics. *New Journal of Physics*, 13(4):043003, 2011, http://dx.doi.org/10.1088/1367-2630/13/4/043003.

[16] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Number fluctuations of cold, spatially split bosonic objects. *Physical Review A*, 84:053622, 2011.

[17] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Quantum dynamics of attractive versus repulsive bosonic Josephson junctions: Bose-Hubbard and full-Hamiltonian results. *Physical Review A*, 82(1):013620, 2010.

[18] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Exact quantum dynamics of a bosonic Josephson junction. *Phys. Rev. Lett.*, 103(22):220601, 2009.

[19] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Reduced density matrices and coherence of trapped interacting bosons. *Physical Review A*, 78(2):023615, 2008.

[20] S. I. Denisov, K. Sakmann, P. Talkner, and P. Hänggi. Rapidly driven nanoparticles: Mean first-passage times and relaxation of the magnetic moment. *Physical Review B*, 75(18):184432, 2007.

[21] S. I. Denisov, K. Sakmann, P. Talkner, and P. Hänggi. Mean first-passage times for an ac-driven magnetic moment of a nanoparticle. *EPL (Europhysics Letters)*, 76(6):1001, 2006.

[22] K. Sakmann, A. I. Streltsov, O. E. Alon, and L. S. Cederbaum. Exact ground state of finite Bose-Einstein condensates on a ring. *Physical Review A*, 72(3):033613, 2005.

[23] O. E. Alon, A. I. Streltsov, K. Sakmann, and L. S. Cederbaum. Continuous configuration-interaction for condensates in a ring. *EPL (Europhysics Letters)*, 67(1):8, 2004.

Books and Book Chapters

[24] K. Sakmann. *Many-Body Schrödinger Dynamics of Bose-Einstein Condensates*. Springer Theses: Recognizing Outstanding PhD Research. Springer Berlin Heidelberg, 2011.

[25] A. U. J. Lode, K. Sakmann, R. A. Doganov, J. Grond, O. E. Alon, A. I. Streltsov, and L. S. Cederbaum. *Numerically-Exact Schrödinger Dynamics of Closed and Open Many-Boson Systems with the MCTDHB Package*, pages 81–92. Springer International Publishing, Cham, 2013.

[26] S. Klaiman, A. U. J. Lode, K. Sakmann, O. I. Streltsova, O. E. Alon, L. S. Cederbaum, and A. I. Streltsov. *Quantum Many-Body Dynamics of Trapped Bosons with the MCTDHB Package: Towards New Horizons with Novel Physics*, pages 63–86. Springer International Publishing, Cham, 2015.

[27] O. E. Alon, A. I. Streltsov, K. Sakmann, and L. S. Cederbaum. Multiconfigurational time-dependent Hartree methods for bosonic systems: Theory and applications. In N. P. Proukakis, S. A. Gardiner, M. J. Davis, and M. H. Szymanska, editors, *Quantum Gases: Finite Temperature and Non-Equilibrium Dynamics*. Imperial Press, London, 2013.