Natalia Saulina, Ph.D.

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Objective

Machine Learning Scientist, Data Scientist

Skills and Experience

- **Strong analytical and mathematical** skills, knowledge of probability theory and statistics.
- **Machine Learning:** reinforcement learning, Hidden Markov Models, XGBoost, Neural Networks (CNN, LSTM, GAN, Graph NN), NLP (relation extraction, topic modeling), Transformers, clustering.
- **Programming:** knowledge of computer algorithms and software developing in Python – Pandas, NumPy, SciPy, Scikit-learn, Statsmodels, TensorFlow (Keras, KerasTuner, TensorFlow Probability)
- Experience with **data processing and data analysis** for JPMorgan Chase.

Work and Research Experience

JPMorgan Chase, Jersey City, NJ and New York, NY   **2016 - 2020**
Quantitative Research

- Developed **'Probability of bank closure'** model in the framework of **inverse reinforcement learning.** Histories of various banks obtained from FDIC data (financial statements, information about bank closures) were considered as expert trajectories and the goal was to infer their distribution and learn expert policy. Both policy and reward of the Markov Decision Process were learned simultaneously.

  Programming:

  - ❏ Implemented in Python guided cost-learning algorithm for maximum entropy inverse reinforcement learning model.

- Developed **'Probability of Default and Rating Migration'** model for JPMC Business Banking portfolio consisting of $20.1B in outstanding loans to customers through 1800 banks in 23 states. This model is used for CCAR and CECL stress-testing as part of the Wholesale Credit Loss Forecast framework and estimates forward-looking default probabilities and rating migrations conditional on macroeconomic scenarios.

  Programming:

  - ❏ Developed packages in Python for processing data, selecting important features using Lasso and SOM, training model for rating transitions, cross-validation and historical back-testing.
  - ❏ Implemented XGBoost and LSTM neural network (using Keras) models as benchmarks.

Rutgers University, New Brunswick, NJ   **2012 - 2015**
Postdoc in High Energy Theory Group
- Constructed spectral networks and introduced higher-web structures in 4d gauge theory with N=2 supersymmetry.

Programming: Developed a package in Wolfram's Mathematica for constructing a monodromy of a flat connection on a Riemann surface with punctures.

Perimeter Institute for Theoretical Physics, Waterloo, Ontario, Canada   **2009 - 2012**
Postdoc in High Energy Theory Group
- Developed methodology for computing algebra of Wilson-t'Hooft loop operators in 4d PSU(K) gauge theory with N=2 supersymmetry for K>2.

Programming: Developed a package in Wolfram's Mathematica for computing cohomology of moduli spaces of solutions of 3d Bogomolny equations with magnetic sources and used it to compute the algebra of Wilson-t'Hooft loop operators for K=3.

California Institute of Technology, Pasadena, CA   **2006 - 2009**
Postdoc in High Energy Theory Group
- Studied line and surface operators in 3d topological field theories.
- Computed algebra of Wilson-t'Hooft loop operators in 4d PSU(2) gauge theory with N=2 supersymmetry.

Harvard University, Cambridge, MA   **2003 - 2006**
Postdoc in High Energy Theory Group
- Counted ground states of a supersymmetric black hole using all-genus amplitudes in topological string theory.
- Studied non-perturbative effects in 4d quantum field theory derived from string theory.

Education:
- **Princeton University**
  Ph.D. in Physics   **2003**
- **Moscow Institute for Physics and Technology,**
  M.S. cum laude in Physics   **1998**

Publications and Presentations:
30 publications in leading international journals in Physics and Mathematics and 16 invited talks at conferences, workshops and seminars. The most important international conferences include:

- '**Gauge Theory and Representation Theory'**, Institute for Advanced Study, Princeton, NJ, November 2007
- **'Strings at the LHC and in the Early Universe',** Kavli Institute for Theoretical Physics, Santa Barbara, CA, March 2010
- **'Algebraic Topology, Field Theory and Strings**', Simons Center for Geometry and Physics, Stony Brook, NY, May 2012