London, UK
May 5, 2018

Cover letter

Dear Sir or Madam,

I am theoretical physicist and machine learning engineer. I have a strong industrial background in data science, machine learning and software development. I have established successful collaborations both in academic and commercial environments, as demonstrated by my publication record and industrial project marketability and success. I also used my time at university to hone my skills as an educator, where my teaching and communication skills received above average reviews in formal evaluations.

Current position

Since August 2016, I have been working as a machine learning engineer and data scientist for TypeScore, a small start-up based in London. The company specializes in developing novel, AI-based solutions for financial risk assessment [1]. As one of two main researchers and data scientists, I am responsible for collection of raw data, testing different machine learning algorithms, development of the final software and its deployment in the cloud. I am also responsible for creating internal documentation and for monitoring the newest developments in machine learning domain, and proposing new research directions for the company.

The software is developed exclusively in Python 3 and utilizes various machine learning algorithms including random forests and artificial neural networks. We analyze a high-dimensional dataset, containing over 1 TB structured and and over 2 TB of unstructured entries (free text). We train our models using cloud services (last year AZURE, currently the Google Cloud Platform), using both multi-core virtual machines and GPUs.

Through my work experience, I gained professional familiarity with not only programming in Python but also with various scientific libraries such as numpy, pandas, SciPy, scikit-learn, tensorflow and Keras. I have also built up experience with software architecture planning and team management. I am familiar with various Linux platforms, bash script language, noSQL databases (MongoDB), ElasticSearch, and cloud computing services (Microsoft AZURE and Google Cloud).

In addition to the technical aspects of my role, I am responsible for monitoring the newest developments in machine learning and proposing new research directions for the company. On my own initiative, I am currently preparing an article for peer review about dimensionality reduction techniques, showing how it can be implemented to predict the probability of business closure. I also lead a reading group where each week, all employees discuss a scientific paper that relates to information retrieval, neural networks or other machine learning techniques. This unique position gave me an excellent opportunities to expand my horizons and learn about the recent developments of artificial neural networks and about many applications of machine learning algorithms in general, not only in business but also in science. To keep afield of the newest developments, I also attend regular meet-ups and lectures (London Machine Learning Group, PyData London, South England Natural Language Processing Meetup and London Data Science Journal Club) that bring together researchers across industry and academia in the Greater London Area, including researchers from Google, Facebook and the Alan Turing Institute.

Detailed description of completed academic projects

During my doctorate, my publications and dissertation focused on strongly-correlated fermion systems and numeric approximation methods used to study many-body problems. In particular I was responsible for development of methods and software for estimating the ground state energy of strongly correlated electron systems [2–4] and for modeling classical and quantum phase transitions in heavy-fermion systems [5–7].

I also have extensive experience working as part of a research group. During my PhD, I was a member of two projects funded partially from European Union grants: "Correlations and coherence in quantum materials and structures (CCQM) – unique properties on macro and nano scale" (2012-2015) and "Fundamental Properties of Strongly Correlated Systems: Unconventional Superconductivity, Quantum Critical Behavior, and Complex Electronic Structure" (2015-2016).

Within the team, my responsibilities included: numerical algorithms design and optimization, development of new computational and statistical methods for the analysis of complex datasets, analytic computation, development of scientific software for physics research (in C++), high-performance computing (HPC) on a university supercomputer, data wrangling, analysis and interpretation. Between these two projects, I published six peer-reviewed articles published in international physics journals, including 3 articles published in *Physical Review B* and one in *Journal of Physics: Condensed Matter* (cf. Refs. 1-6).

Additionally, during my bachelor's degree in computer science, I was involved in a project which aimed to explain the orientation of hard spheroplatelets (particles with shape between rods and plate) near a wall under different conditions. One of the challenges was to efficiently calculate the excluded volume of the particles. The existing algorithms were too slow to obtain the results in a reasonable time. Using stochastic methods to select the most interesting configurations and using OpenMP to utilize parallel computation, I was able to increase the speed of our algorithm by two orders of magnitude. I was responsible for the software development (in C++) and final multi-core calculations on a supercomputer. The work resulted in an article published in a prestigious scientific journal, Physical Review E [8].

Teaching and organization experience

I have developed my teaching skills both in a university setting and in my community. I have extensive experience preparing lectures and tutorials, teaching both large and small classes. During my PhD, I revitalized and led a course for high school students on advanced physics topics and numerical methods. Many of my students went on to be competitive participants in regional, national and international competitions (one our student got silver medal on 7th International Olympiad on Astronomy and Astrophysics, others obtained several finalist titles in the National Physics Olympiad). At the university, I also taught several undergraduate-level courses, including Statistical Physics recitation sessions for third-year physics undergraduates. Students evaluated my teaching skills as "superior", namely at 4.88/5.0 in 2013 and at 4.97/5.0 in 2014, while the annual university averages were 4.40 and 4.36 respectively.

I am an active member of the PyData community. I helped with the organization of the PyData London 2018 Conference. I also volunteered as an instructor during the recent Python Data Science Beginners Bootcamp, where I led a session about Natural Language Processing.

Yours sincerely,

Dr Marcin Abram

References

[1] An online portal offering free businesses credit scores, `https://openriskexchange.com/`, [Online; accessed May 1, 2018].

[2] M. Abram, J. Kaczmarczyk, J. Jędrak, and J. Spałek, *d-wave superconductivity and its coexistence with antiferromagnetism in the t–J–U model: Statistically consistent Gutzwiller approach*, Phys. Rev. B **88**, 094502 (2013).

[3] M. Abram, *t–J–U Model in Mean-Field Approximation: Coexistence of Superconductivity and Antiferromagnetism*, Acta Phys. Pol. A **126**(4a), A–25 (2014).

[4] M. Abram, M. Zegrodnik, and J. Spałek, *Antiferromagnetism, charge density wave, and d-wave superconductivity in the extended t-J-U model: role of intersite Coulomb interaction and a critical overview of renormalized mean field theory*, J. Phys. Condens. Matter **29**(36), 365602 (2017).

[5] M. M. Wysokiński, M. Abram, and J. Spałek, *Ferromagnetism in UGe_2: A microscopic model*, Phys. Rev. B **90**, 081114(R) (2014).

[6] M. M. Wysokiński, M. Abram, and J. Spałek, *Criticalities in the itinerant ferromagnet UGe_2*, Phys. Rev. B **91**, 081108 (Feb 2015).

[7] M. Abram, M. M. Wysokiński, and J. Spałek, *Tricritical wings in UGe_2: A microscopic interpretation*, J. Magn. Magn. Mater. **400**, 27 (2016).

[8] A. Kapanowski and M. Abram, *Model of hard spheroplatelets near a hard wall*, Phys. Rev. E **89**, 062503 (Jun 2014).