(Preliminary) Career Development Plan -Year 1

The ESR started in April 2021 so this is a preliminary plan.

Name of fellow: Seyed Siamak Ghodsi

Department: L3S Research Center, Hannover, Germany
Free University of Berlin (FUB)

Name of Supervisor: Prof. Dr. Eirini Ntoutsi, Free University Berlin (FUB)

Date: 19-05-2021

Brief overview of research project and major accomplishments expected:

The Individual Research Project (IRP) assigned to Siamak Ghodsi is titled "*Time-dependent monitoring and mitigation for bias*" and belongs to the work package "*Accounting for bias in results*". The goal of the project is bias detection and mitigation for non-stationary data, which are generated from temporal and streaming applications. For many practical cases, decision making is not a one-shot process, but rather an ongoing activity which produces different models and results over time as well as feedback loops. This IRP addresses the discovery and mitigation of bias in time-evolving models. As part of this project, data-ageing techniques inspired by the domains of data stream mining and adaptive ML as well as data augmentation techniques for non-stationary data will be investigated to balance the representation of the different population segments over time. Moreover, Siamak's background and experience with Multi-Objective Optimization methods which, in general, cope with simultaneous optimization of different aspects of a learning problem will be exploited towards the goal of the project. In particular, we plan to incorporate multi-objective optimization algorithms with fairness-aware learning notions by trying to embed fairness as an objective into the problem definition, to be optimized along with the overall performance of the learner. Such a formulation is very flexible and can be used to tackle more complex fairness-notions like multi-fairness, where more than one protected attributes might contribute to discrimination. The latter aspect is very important for the IRP as the discriminatory behavior of a model might be based on different (protected) features over time.

Expected Results:

Methods for bias detection and mitigation in online machine learning environments where data characteristics might change with time and different (protected) attributes might contribute to discrimination.

LONG-TERM CAREER OBJECTIVES (OVER 5 YEARS):

Siamak is expected to obtain solid research and development skills and to produce high scientific outputs in the area of Fairness-aware Machine Learning. Moreover, he is expected to actively collaborate and participate in interdisciplinary collaborations within the ITN, the consortium and the FATML and ML community more generally. As a result, through this PhD career, Siamak will gain valuable soft skills (e.g. academic communication, team-work, leadership, critical thinking, time-management, adaptability, ...) that will further prepare him for the job-market.

1. Goals:
    - Achieve in-depth scientific knowledge and technical competence, appreciated by the labour market in both academic and industrial institutions in the fields of (Applied) Machine Learning, Optimization, Data Science and Responsible AI but also in relevant disciplines (Social Science, Ethics).
    - Acquiring independence and competence in research development: Being able to manage a research project confidently and successfully, as demonstrated by publications in top-tier venues in his corresponding research area.
    - Soft skills: Communicating about research results in terms of written essays (blog posts) and presentations. Collaborating smoothly and effectively in multi-disciplinary teams (NoBIAS, AIML group at FUB).
    - Further research activity or other training: Being involved in scientific event organization (e.g. workshops), special issue editing, preparing and presenting tutorial(s) in the context of a conference or summer school.
    - Ability to communicate at an interdisciplinary level, by a continuous cooperation
      and dialogue between academia and other (partner) companies. In this way, Siamak Ghodsi will become aware of the technical languages, the scientific methodologies and instruments that characterize them.

2. What further research activity or other training is needed to attain these goals?
    - The planned Individual Research Project is intended and is expected to give Siamak Ghodsi the methodological guidelines and best practices to attain the previously mentioned goals, together with the opportunity to apply them to an actual research and development problem in the specific field of interest of the NoBIAS project. Further interdisciplinary applications will allow Siamak to

refine the developed approaches and possibly to employ them in different applications.

SHORT-TERM OBJECTIVES (1-2 YEARS):

1. Research results
    - Anticipated publications:
        - Publications in top-ranked conferences (e.g., FAccT, PMLR, IJCAI, AAAI, KDD, …). In particular, contributing some method for bias detection and/or mitigation in online settings.
        - Publications in top specialist journals in the field (e.g. DAMI, KAIS, DKE, ACM Computing Surveys…). In particular, Siamak is expected to write a survey on multi-objective optimization for fairness as well as on online methods to fairness.

    - Anticipated conference, workshop attendance, courses, and /or seminar presentations:
        - Weekly research seminar in the AIML group FUB (group with about 10 participants).
        - Weekly ESR talks
        - Deep Learning online course (FUB Deep Learning by Frank Noe[1] (currently attending).
        - IJCAI 2021, August 21-26
        - NIPS 2021 (Workshops of: “Black in AI”, “Women in AI (WiML)”, “Bayesian Deep Learning”, “Information Theory and Machine Learning”), Dec 6-14, 2021
        - SIGKDD 2021, August 14-18
        - ICML 2021, August 18-24
        - CIKM 2021, November 1-5
        - FAccT 2022
        - AAAI 2022, Feb 2-9
        - Convex Optimization course (Carnegie Mellon University)[2].

2. Research Skills and techniques:
    - Training in specific new areas related to the project, or technical expertise etc:
    - Research about Online Machine Learning
    - Fairness-aware Learning with a focus on Multi-Objective Fairness
    - Mathematical Modelling and learning theory[3],[4]
    - Bayesian inference
    - Markov models
    - Programming skills (e.g. Python packages for time series)
    - Data Visualisation
    - Ethics and Intellectual Property Rights management

[1] Deep Neural Networks by Frank Noe
[2] Ryan Tibshirani: Convex Optimization
[3] Marc Peter Deisenroth: Mathematics for Machine Learning
[4] Shai Shalev-Shwartz: Understanding Machine Learning: From Theory to Algorithms

3. Research management:
    - The NoBIAS overall work plan demands a strong interaction among the Work Packages and among the ESRs in charge of them in turn. Hence, all ESRs are required to acquire and apply skills appropriate to working with others across different disciplines, and in team-building. Siamak Ghodsi will collaborate with his supervisor to acquire and apply skills appropriate to work programming, deadlines, and delivery. He will be also involved in the reviewing process of scientific papers in conferences and journals.

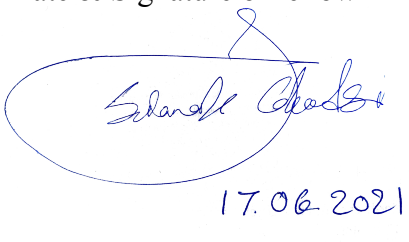
4. Communication skills:
    - Read materials and tutorial notes on academic writing and scientific communication[5].
    - Extend written scientific communication skills by writing papers in refereed journals and conferences.
    - Presenting at conferences, seminars, and workshops for oral communication improvement.
    - Participation at different NoBIAS events.

5. Other professional training (course work, teaching activity):
    - Involvement in student thesis supervision (bachelor, master)
    - Mentoring activities and tutorials (currently mentoring at a graduate course)

6. Anticipated networking opportunities
    - Social media activities: introducing/distributing our ITN-Network (through Twitter: @NoBIAS_ITN, NoBIAS newsletter, blogging, etc.)
    - NoBIAS Summer Schools

7. Other activities (community, etc) with professional relevance:
    - German Class
    - Planned Secondments at Open University and Expert Systems Lab.

Date & Signature of fellow



Date & Signature of supervisor

17/6/2021

[5] Justin Zobel: Writing for Computer Science