Habilitation Board Decision on the Nomination for Appointment to Associate Professor

Masaryk University	
Faculty	Faculty of Informatics
Procedure field	Informatics
Applicant	Petr Novotný, Ph.D.
Applicant's home unit, institution	Faculty of Informatics, Masaryk University
Habilitation thesis	Code and Design Safety of Probabilistic Systems
Board members	
Chair	prof. RNDr. Petr Hliněný, Ph.D. *Faculty of Informatics, Masaryk University*
Members	Prof. Javier Esparza *Technical University of Munich, Germany* prof. RNDr. Petr Jančar, CSc. *Palacký University Olomouc* prof. Dr. rer. nat. RNDr. Mgr. Bc. Jan Křetínský, Ph.D. *Faculty of Informatics, Masaryk University* doc. Mgr. Adam Rogalewicz, Ph.D. *FIT VUT v Brně*

Evaluation of the applicant's scholarly/artistic qualifications

When evaluating the applicant's scientific qualifications, the Board based its decision on the submitted materials, in particular, on the list of publications, CV and research topics of the applicant. It follows from these materials that the applicant has published his results in 27 refereed proceedings and two journal papers. Namely, these include 15 papers at conferences of the prestigious CORE A* rank (roughly equivalent to D1 journals, which is an exceptional performance) and 8 at conferences of the CORE A rank (equivalent Q1). The only two journal papers are both of AIS Q1 ranking, and one has to stress that such publication pattern strongly favouring prestigious refereed conferences over journals is quite common in Computer Science. The author lists of all mentioned papers are sorted alphabetically.

The contribution of applicant’s papers is in the area of analysis and control of probabilistic systems, in particular (i) termination analysis of probabilistic programs, and (ii) control of partially observable Markov decision processes (POMDP) with safety guarantees. Both areas lie at the forefront of the current research in probabilistic verification and safe learning and belong to very actively developed topics of formal methods and artificial intelligence. The importance of the results for both areas of computer science is clearly documented by the publishing venues of the papers. They include A* conferences in both formal methods (such as LICS, CAV, or POPL) and artificial intelligence (such as AAAI, or UAI). Specifically, the topic of program termination belongs to the very classics of computer science and the provided lifting to the probabilistic setting via supermartingales is a crucial step both on the theoretical side, linking the areas of termination analysis and probability theory, and the practical side since probabilistic programming has recently gained great practical relevance. Similarly, the topic of extending POMDP control with safety guarantees poses theoretical challenges, which the applicant addressed with combinations of techniques from verification and learning. The provided results are then relevant for important applications in safe deployment of AI-based systems such as robotics. Altogether, this broad spectrum of techniques combined by the applicant enriches the state of the art significantly from both the theoretical and practical perspective.

Application materials list 141 non-self (as applied to all coauthors) citations to Petr Novotný’s works in the Scopus database, and the Board has checked that the current number is 151. This is well above the expected values. Applicant’s h-index in Scopus is 9, and 7 when excluding all self-citations. His most cited paper, Stochastic invariants for probabilistic termination from POPL 2017, has attracted 22 non-self citations. The Boards has not checked these numbers in the WoS database since applicant’s ResearchID profile in WoS is very incomplete, and his ORCiD profile in WoS includes numerous papers from other disciplines.

Petr Novotný also gained extensive international experience during his 3-year postdoc position at IST Austria, one of the top research institutes in Europe, and has got a large network of collaborators abroad. He has received a Czech Science Foundation grant (GA23-06963S) since 2023 in collaboration with Brno University of Technology, which proves that he is a mature young scientist ready to form his own successful research group at FI MU. The three evaluations of the submitted Habilitation thesis, as separately mentioned below, also explicitly support this highly positive view of the applicant’s readiness for the promotion.

Conclusion: The applicant's scholarly/artistic capabilities **meet** the requirements expected of applicants participating in a habilitation appointment procedure in the field of Informatics.

Evaluation of the applicant's pedagogical experience

The applicant Petr Novotný received his Ph.D. in Computer Science in 2015. Already in the years 2008 - 2013 he was involved in teaching tutorials of various mathematical and theoretical-CS courses at FI MU. Since 2018 he has been employed as an Assistant Professor at FI MU, and has been teaching lectures of IB110 Introduction to Informatics for 3 semesters, of IA174 Fundamentals of Cryptography for 2 semesters, in addition to regularly taught tutorials of (other) subjects. He has also been the teacher of the seminar DUVOD Introduction to PhD study since 2018.

According to the submitted materials, the applicant has supervised 9 Bachelor's theses (plus 4 in progress) and 6 Master's theses. The IS MU records supervision of 15 theses of both levels, and consultancy of 1 other work, all since 2019. These numbers are quite good given the theoretical nature of applicant's research, the count is over 3 theses per year, and show the applicant's readiness for promotion to the Associate Professor level.

The Board has also evaluated applicant's public lecture entitled Static Analysis of Termination and Safety Properties in Probabilistic Programs, which took place on April 11, 2023 at FI MU. The lecture was attended by 3 members of the Board in person, and one more member connected online and also provided his opinion on the lecture. The lecture fully demonstrated the applicant's technical and presentation skills, and his deep knowledge of the area, and at the same time the lecture was full of nice examples and visualisations targeting the general audience.

Conclusion: The applicant's pedagogical capabilities **meet** the requirements expected of applicants participating in a habilitation appointment procedure in the field of Informatics.

Habilitation thesis evaluation

The applicant has submitted a Habilitation thesis entitled Code and Design Safety of Probabilistic Systems. The thesis consists of 59 pages of original introduction and commentary text, 12 pages of bibliography, and reprints of 9 papers from the years 2017–2021. All these included papers are co-authored by groups of authors (in alphabetical order) including the applicant, and the thesis specifies the applicant's contribution to each of them. All of them include foreign co-authors.

The Board has selected and invited the following three reviewers of the Habilitation thesis:

Professor Alessandro Abate (Oxford)

Professor Roderick Bloem (Graz)

Associate Professor Nils Jansen (Radboud)

All of them are renowned international experts in areas closely related to the applicant's thesis, and all their three reports agree that the thesis fulfils the requirements expected of a Habilitation thesis in the field of Informatics.

The Board would especially like to highlight the following parts of the reviews:

Prof. Roderick Bloem summarises the thesis content: "The thesis comprises 9 closely interrelated papers, the majority of which were published in renowned conferences. This work represents a significant advancement in extending system analysis, which previously had been primarily focused on non-probabilistic systems, to probabilistic systems. ……... Probabilities make the analysis of systems much more complicated and give rise to entirely new questions that have no counterpart in the non-probabilistic setting."

He also writes: "In conclusion, I am extremely impressed by Petr Novotný's research. He has clearly demonstrated that he is an excellent researcher in theoretical computer science, who is able to develop novel ideas with relevant motivations and rigorous mathematical content, accompanied by implementations where applicable. His ability to communicate difficult ideas in a surprisingly accessible manner will serve him well in his research and teaching career."

Prof. Nils Jansen assesses the thesis as: "The submitted thesis is, according to the specified thesis type, a 'collection of previously published… works…'. I want to, however, argue that this document has significantly more value than a mere collection of articles would. In the 'commentary on the enclosed publications', the author provides an introduction and overview of the contributions that goes over 60 pages. I think that this overview is a great document that can readily be provided to starting researchers who would like to, for instance, receive an introduction to the area of probabilistic program verification."

In a summary, he writes: "To summarize, the contributions are strong, have been published at high-profile venues under strong competition, and provide the basis for a plethora of further research."

Prof. Alessandro Abate in his report generally addresses the candidate's scientific record and achievements, and finds them very good. Then he writes, among other things, the following: "I have much enjoyed reading the habilitation thesis, especially since I am quite familiar with the area and with the applicant's past work. It was a pleasure to read his perspective on the problems that are currently under investigation in this area of work. …… In conclusion, the author has managed displaying that he is a key contributor to this area, having made an impactful and deep contribution to problems of high interest for the community working in this area."

Based on the reviews, the Board has no doubts that the submitted Habilitation thesis is an excellent piece of scientific work.

Conclusion: The applicant's habilitation thesis **meets** the requirements expected of habilitation theses in the field of Informatics.

Habilitation Board Decision on the Nomination for Appointment to Associate Professor

Secret vote results

Voting took place: electronically

Number of board members		5
Number of votes cast		5
of which	in favour	5
	against	0

Board decision

Based on the outcome of the secret vote and following an evaluation of the applicant's scholarly or artistic qualifications, pedagogical experience and habilitation thesis, the board hereby submits a proposal to the Scientific Board of the Faculty of Informatics of Masaryk University to **appoint the applicant associate professor** of Informatics.

In Brno on 04.05.2023

prof. RNDr. Petr Hliněný, Ph.D. .....