OPPINION

by DSc. Stoyan Milkov Mihov, Associate Professor at IICT-BAS
in a procedure for **"associate professor"**
in professional field 4.5 "Mathematics" (Mathematical logic)
for the single candidate
Dr. Stefan Vladimirov Gerdjikov - senior assistant professor at the Department of Mathematical Logic and its Applications at the FMI of Sofia University

In accordance with order RD 38-84/10.02.2021 of the Rector of Sofia University “St. Kliment Ohridski” I have been appointed as a member of the scientific jury under the present procedure.

Biographical information

Senior Assistant Professor Dr. Stefan Vladimirov Gerdjikov received a bachelor's degree in informatics in 2006 at the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski”. During 2005-2006 he was a Erasmus student at the Technical University of Karlsruhe. In 2008 he obtained a master's degree in Logic and Algorithms at FMI at Sofia University. In 2014, again at FMI at Sofia University, he defended a PhD dissertation for awarding the scientific and educational degree "Doctor". In the period 2014-2016, Dr. Gerdjikov won a scholarship for a postdoctoral fellow in the Marie-Curie program at Ludwig-Maximilians University in Munich.
Dr. Gerdjikov worked in 2005-2006 as an assistant at the Technical University of Karlsruhe, in 2007-2009 as an assistant at the FMI of Sofia University and in 2010-2011 as a programmer at IICT-BAS. From the beginning of 2012 he was appointed a mathematician, and from the middle of 2012 an assistant at the FMI of Sofia University. In 2014 he was elected chief assistant at the FMI of Sofia University, and since 2016 he has been appointed part-time at IICT - BAS. Dr. Gerdjikov carries out a rich and busy teaching and extracurricular activities and has won a number of scientific awards and prizes. He has also participated in two nationally funded projects and two European funded projects under the Seventh Framework Program.

General description of the presented materials

The materials presented by Dr. Stefan Gerdjikov have been prepared in accordance with the Development of Academic Staff in the Republic of Bulgaria Act, the regulations for the application of this act and the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski”. These include: 1) CV, copies of the diploma for higher education and the diploma for educational and scientific degree "Doctor"; certificate of employment, length of service; 2) a complete list of the scientific works of Dr. Gerdjikov, a list of the publications submitted for participation in the procedure and a list of publications, conferences, projects and scientific manuals, generated by the “Authors” system; 3) report for fulfillment of the minimum requirements under art. 2b of Development of

Academic Staff in the Republic of Bulgaria Act; 4) list of observed citations; 5) reference for the original scientific contributions and reference with indicators under art. 112 para. 2; 6) copies of the printed scientific publications by groups В. and Г. and the resumes of the publications submitted for the procedure in Bulgarian and English; 7) screenshot of the procedure announcement.
The report for fulfillment of the minimum requirements for academic position “Associate Professor” in direction 4.5 “Mathematics” contains in tabular form data by groups of indicators А, Б, Г and Д. The points on the given indicators fully satisfy the requirements for acquiring the academic position “Associate Professor”.

General characteristics of the candidate's activity

Dr. Stefan Gerdjikov is a distinguished young scientist in the field of mathematical logic and its applications. His research interests are focused on the theory of automata and approximate search, as well as their applications. He is a frequent participant and speaker at the world's leading scientific conferences in the field of automata theory, including Language and Automata Theory and Applications and Conference on Implementation and Application of Automata.

Scientific contributions presented in the dissertation

There are 9 publications presented for the procedure, which are grouped in 5 thematic topics.
The first topic covers results related to efficient constructions bimachines. This area includes the articles [2,3] from the list of articles submitted for the procedure. Both works are co-authored with Klaus Schulz and Stoyan Mihov. The first article discusses a direct construction of bimachine, which avoids the construction of an intermediate unambiguous transducer. Dr. Gerdjikov's contribution consists in the variant of the construction, in which an order is introduced for the choice of the paths, as well as the asymptotic estimate by O(n!) For the complexity of the algorithm. The main result in the second article - a construction achieving complexity $O(2^n)$, as well as the example of a lower limit $\Theta(2^{n/4})$, are the contributions of Stefan Gerdjikov. This construction was published in 2019 in a journal with impact factor and is currently the most (asymptotically) effective method for constructing a bimachine.
The second thematic topic is related to the axiomatization of the output monoids of the finite transducers, for which constructions for sequentialization, canonization and minimization are possible. This area is covered in the articles [1,4], in which Dr. Gerdjikov is the only author. In these articles, our earlier idea of generalizing the properties of monoids, which allow construction for sequentialization, is significantly extended and abstracted. In his work, Dr. Gerdjikov chooses an algebraic approach, which manages to obtain an elegant and natural characterization of the classes of monoids that allow the given constructions. The results were reported at the leading conferences on the theory of automata.
The third topic is a joint result with Jose Ramon Gonzalez de Mendivil, published in the article [6]. This work explores the relationship between the property of monoids to allow maximum factorization and the mge-monoids introduced earlier by Klaus Schulz in [3]. The main contribution of Dr. Gerdjikov in this work is to show that the maximum factorization of monoids with right contraction is equivalent to the existence of infimums in enumerable sets. The work was reported in a journal with impact factor 3.3.

The fourth topic is a joint result with Alexander Wolff, published in the article [5]. A new algorithm for decomposition of simple polygons into convex polygons is presented. Dr. Gerdjikov's contribution is in developing an effective algorithm based on dynamic programming, performing the required decomposition. The result was reported at a conference on computational geometry and published in a journal with impact factor.
The fifth thematic topic focuses on approximate search methods and their applications. The results on this topic are published in the articles [7,8,9], which are joint. The article [7] presents the WallBreaker approximate search algorithm, jointly developed by Peter Mitankin, Stoyan Mihov and Klaus Schulz. The article makes an empirical comparison of WallBreaker with other approximate search methods. Our algorithm won first place in the international scientific competition Scalable String Similarity Search / Join, part of the EDBT / ICDT Workshop, Genoa, 2013. Articles [8,9] present applications of approximate search methods for normalization of (historical) texts in the presence of noise. This task was the subject of the CULTURA project under the Seventh Framework Program. Dr. Gerdjikov has a significant contribution to the development of the method and the implementation of the system for normalization of historical texts, both in the presence [8] and in the absence [9] of a parallel corpus. The article [7] was published in an edition with impact factor, and the results [8,9] were reported at specialized conferences in the field of document processing.
The results presented in the first three thematic topics provide answers to some important questions in the field of finite transducers and bimachines. In my opinion these results represent an important contribution to the modern theory of finite state machines, as evidenced by their presentations at leading conferences in the field and their publication in renowned scientific journals with an impact factor. The fourth and fifth thematic topics are in more applied areas. In addition to the publication of the results in the publications with impact factor, the significance of the first place in the international scientific competition in approximate search is indicative of their significance. The noted 19 citations of Dr. Gerdjikov's works are an additional recognition of his scientific contributions.

Assessment of the candidate's personal contribution

The original scientific contributions of the application are set out in 9 published articles. Two of the published articles are authored by Dr. Gerdjikov only, and the other 7 are co-authored. I accept and evaluate the description of the personal original contributions, presented in the relevant report, as complete and correct.

Personal impressions

With Stefan Gerdjikov we have many years of joint academic activity within which a number of scientific and scientific-applied results have been achieved. I have known Dr. Gerdjikov since 2007, when he attended the course Applications of finite state machines. In 2008 I was the supervisor of his dissertation, and in the period 2009-2012 I was the supervisor of his doctoral dissertation. Stefan Gerdjikov also participated in the IMPACT project, of which I was the local coordinator. Also, for several years Dr. Gerdjikov led the exercises to the course Applications of finite state machines, where I was a lecturer. I am a co-author of four of the articles submitted for the procedure.
I highly appreciate his scientific achievements and academic experience. A strong impression makes his tendency to delve into the theoretical foundations of the problems

to be solved and to seek in-depth abstract solutions. In this way, he often finds asymptotically optimal constructions for nontrivial tasks. Also, I would like to mention the course "Fast Algorithms on Data Structures", which he and Dr. Mitankin introduced in the curriculum at the Department of Mathematical Logic and its applications. This course is very popular and significantly develops students in the use of an analytical approach in computer science.

Conclusion

After getting acquainted with the materials of the procedure, the complex evaluation of the scientific results presented in therein, and taking into account the personal qualities of the candidate, I strongly recommend to award to Senior Assistant Professor Dr. Stefan Vladimirov Gerdjikov the academic position "Associate Professor" in the professional field 4.5 "Mathematics".

March 30, 2021

Sofia

Member of the scientific jury:

Assoc. Prof. D.Sc. Stoyan Mihov