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# Conference Report on 2021 IEEE Congress on Evolutionary Computation (IEEE CEC 2021)

Sponsored by IEEE Computational Intelligence Society (CIS), the IEEE Congress on Evolutionary Computation (IEEE CEC) is the flagship event in CIS that focuses on the entirety of the Evolutionary Computation (EC) field. The conference promotes all aspects of theory, algorithm design and applications of EC and related research areas that focus on mimicking nature to solve problems.

A broad range of topics related to evolutionary computation makes IEEE CEC an excellent forum for bringing together researchers and practitioners from all over the world to present and discuss their research findings and future prospects of the field of evolutionary computation.

In 2021, IEEE CEC was organized in Kraków, Poland. However, due to COVID-19 restrictions, it was held fully virtually between June 28th and July 1st 2021.

IEEE CEC 2021 has attracted 542 papers submitted by 1460 authors from 60+ different countries. Among the submissions, a large number of papers demonstrated refreshing theories and concepts, supported by strong, compelling analytical and empirical analyses. Each paper received a minimum of 2 reviews, with an average of 3.4 reviews, made by 575 reviewers. Under the guid-



**FIGURE 1** General Co-Chair Jacek Mańdziuk delivering the opening speech at IEEE CEC 2021.

ance of the Program Co-Chairs, Conflict of Interest Chair and Technical Co-Chairs, and the help of special session organizers, 324 papers from 910 authors were finally accepted and virtually presented.

Accepted papers represent a diverse view of the latest advances in the area and give a preview of our further commitment to drawing inspiration from nature for solving challenging real problems. The organizing committee is truly humbled by this impressive display of support for the congress despite the global pandemic situation.

On the first day of the conference, 28th June, there were 24 tutorials and two workshops offering a great opportunity to disseminate in-depth information on specific areas of evolutionary computation. The tutorials and

workshops covered a diverse range of topics from algorithmic design of multi-/many-objective optimization, large-scale optimization, hyperheuristics, evolutionary machine learning, evolutionary multitasking, computer vision, games, to theory and real-world applications. In order to maximize the educational and research training benefits from these tutorials, all tutorials were made available free-of-charge to all attendees.

IEEE CEC 2021 featured six plenary lectures given by world-leading scholars in the field of evolutionary computation:

❑ *When Everything Else Fails, Try Coevolution* by Prof. Xin Yao
❑ *Towards robust and secure robot swarms* by Prof. Marco Dorigo
❑ *AI-based business applications and the EC research* by Prof. Zbigniew Michalewicz
❑ *Lessons Learned after 25 Years Designing Multi-Objective Evolutionary Algorithms* by Prof. Carlos Artemio Coello Coello
❑ *Evolutionary Multiobjective Optimization with Humans in the Loop* by Prof. Roman Słowiński
❑ *Neuroevolution: A Synergy of Evolution and Learning* by Prof. Risto Miikkulainen

All plenary lectures presented the audience with cutting-edge research and technologies in the field of evolutionary computation. Four of them were given on the occasion of receiving

**FIGURE 2** Prof. Ray Liu, 2021 IEEE President-Elect presents the prestigious 2020 Frank Rosenblatt Award to Prof. Xin Yao "For contributions to the advancement of the theory and applications of computational intelligence".
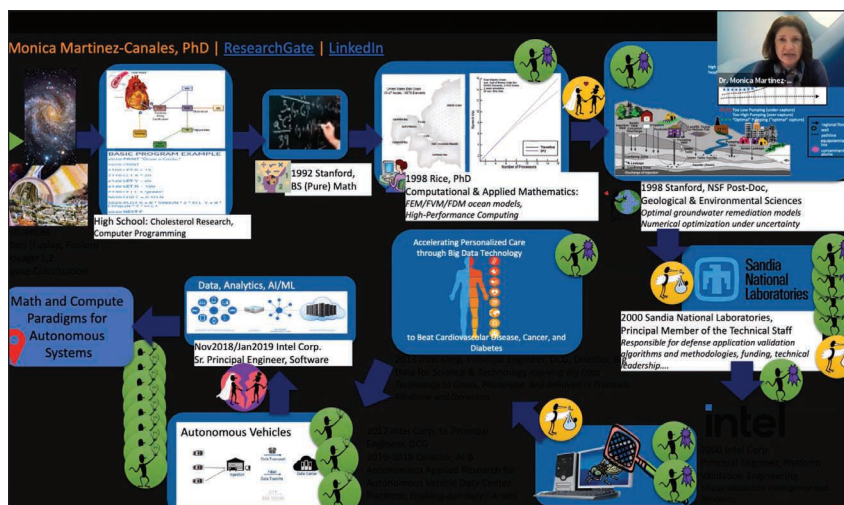


**FIGURE 3** Panel discussion on "Journeys to Success within in the Computational Intelligence Industry". Speaking: Monica Martinez-Canales, Ph.D.
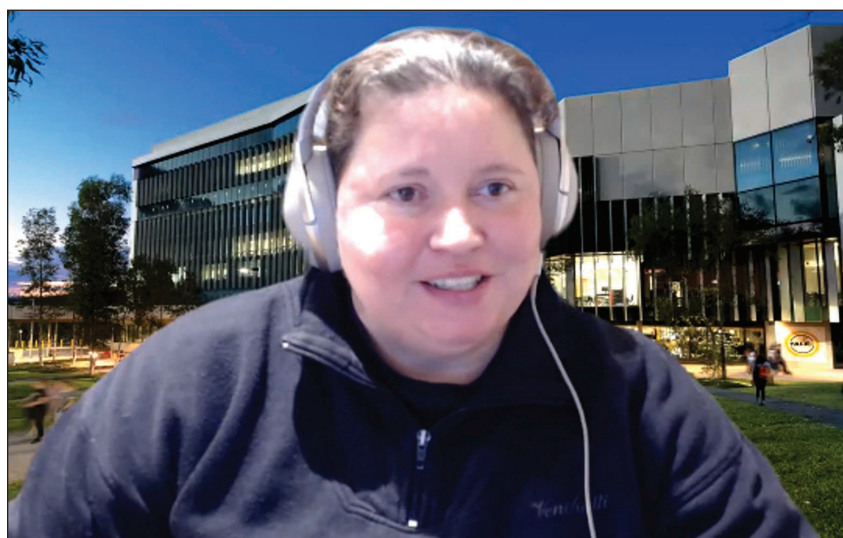


**FIGURE 4** IEEE CIS Student Chapter Forum chaired by Dr. Mardé Helbig.

prestigious IEEE and IEEE CIS awards that were presented at a special Awards Ceremony. The award session was co-hosted by Prof. Bernadette Bouchon-Meunier, 2020–2021 IEEE CIS President and Prof. Jacek Mańdziuk, CEC 2021 General Co-Chair with special attendance of Prof. Ray Liu, 2021 IEEE President-Elect. During the live ceremony, recognition was given to the recipients of the following awards: 2020 Frank Rosenblatt Award (Xin Yao), 2019 IEEE CIS Evolutionary Computation Pioneer Award (Zbigniew Michalewicz), 2020 IEEE CIS Evolutionary Computation Pioneer Award (Risto Miikkulainen), 2021 IEEE CIS Evolutionary Computation Pioneer Award (Carlos Coello Coello), 2021 Early Career Award (Zhi-Hui Zhan), 2021 Outstanding PhD Dissertation Award (Shouyong Jiang) and 2021 Outstanding Organization Award (McAfee – Celeste Fralick and Catherine Huang). Furthermore, the 2020 IEEE Transactions on Evolutionary Computation Outstanding Paper Award and four CEC 2021 Best Paper Awards were presented to the authors.

To further bolster the technical content, the Congress offered two engaging panel sessions devoted to "Evolutionary Computation in Real-World Applications" and "Journeys to Success within in the Computational Intelligence Industry", as well as 10 challenging competitions referring to various contemporary topics in evolutionary computation.

The CEC 2021 also organized the IEEE CIS Student Chapter Forum and a Student and Early Career Mentoring Program that served to connect and inspire young professionals. Besides regular sessions, the conference attracted 63 special session proposals that led to 28 dedicated special sessions organized by domain experts covering focused topics. For the cases where scheduling constraints and the number of accepted papers did not allow for a dedicated special session slot, the corresponding papers were merged with an appropriate regular session with common theme. All sessions were highly

attended and provided significant value to attendees.

Apart from the technical program, there were two special sessions presenting a pre-recorded Virtual Tour on Kraków with live commentary of professional tour guide, followed by live Q&A discussion. Throughout the congress certain socializing and networking opportunities were provided for the

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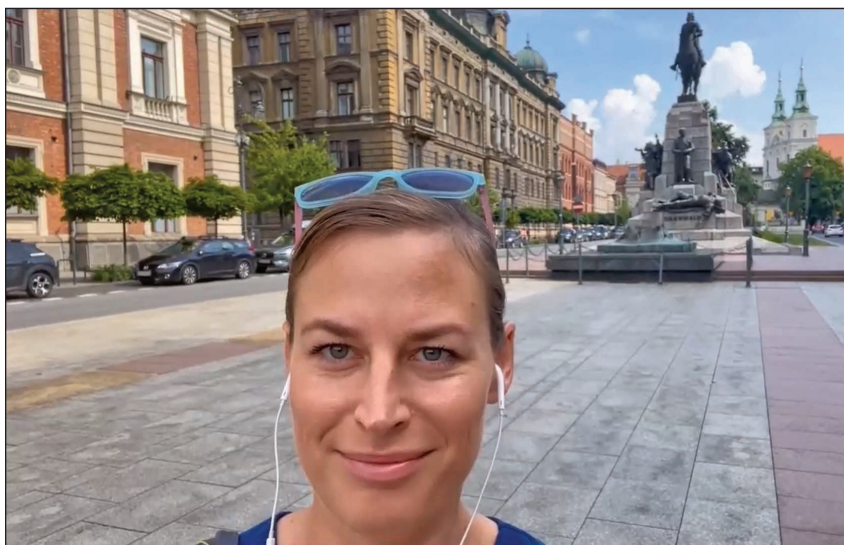


**FIGURE 5** Special session dedicated to Virtual Tour on Kraków presented by Ms. Janina Naskalska Babik, professional tour guide.

attendees on the CONFLUX Virtual Conference Platform. CONFLUX served as the main hub for all activities, allowing participants to access all live sessions, all pre-recorded content on-demand, and interact with fellow attendees and presenters through posting of public and private questions and messages.

We would like to take this opportunity to express our sincere gratitude to everyone who has contributed for making IEEE CEC 2021 a success. In particular we wish to acknowledge great support of our Program Co-Chairs Yew Soon Ong and Hemant Singh who ensured high scientific standards of the conference and additionally supported us in many other aspects.



## Best Paper Award Nominees (BPA-II)

- Paper #129, Portfolio Search and Optimization for General Strategy Game-Playing, by *Dockhorn Alexander, Hurtado-Grueso Jorge, Jeurissen Dominik, Xu Linjie and Perez-Liebana Diego*

- Paper #24, A Random Walk Analysis of Search in Metaheuristics, by *Stephen Chen, Shehnaz Islam, Antonio Bolufe Rohler, James Montgomery and Tim Hendtlass*

- Paper #364, Blending Dynamic Programming with Monte Carlo Simulation for Bounding the Running Time of Evolutionary Algorithms, by *Kirill Antonov, Maxim Buzdalov, Arina Buzdalova and Carola Doerr*

- Paper #164, An Evolutionary Algorithm Taking Account of Epistasis among Parameters for Black-Box Discrete Optimization, *Sho Shimazu and Isao Ono*

- Paper #192, Hypervolume by Slicing Objective Algorithm: An Improved Version, by *Sumit Mishra, Srinibas Swain, Sangita Sarmah and Carlos A. Coello Coello*

**FIGURE 6** Program Co-Chair Hemant Singh chairing the Best Paper Award session.

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Special mention to Pietro Oliveto and Jan Karwowski for their fantastic job with proceedings preparation. We would also like to extend our thanks to all members of the organizing committee, the plenary and tutorial speakers, the special session, workshop and panel session organizers, the reviewers, the conference participants, and all contributing authors who presented their high quality research.

Finally, we would like to acknowledge the support provided by two PCOs - Jordan from Kraków, Poland supporting the initial CEC 2021 organization, and Conference Catalysts from Gainesville, USA supporting virtual conference organization that included the provision of their CONFlux Virtual Conference Platform.

We look forward to the next successful edition of IEEE CEC 2022 as part of IEEE World Congress on Computational Intelligence (WCCI) 2022, 18-23 July 2022, in Padua, Italy.

Attendee feedback on what they liked about CEC 2021:

"I loved all the presentations with great topics exploring all subjects in today's world. Very good platform for all types of presentations."

"The topics are always interesting."

"Very well organized."

"Very helpful organizing staff members, very friendly session chairs and presenters. Very professional technical setup."

"Excellent keynotes"

"The virtual platform is an excellent way of communicating when the times did not allow us to travel in person. It had an advantage of linking a researcher to the expert of the field directly. But, of course, travelling to a place and discussing all these things in person gives new experiences and enthusiasm for work. Thank you for organizing this conference and all the people for sharing their knowledge☺"

"Thank you for going through with this conference despite the pandemic and all the hard work of the organizers!"