1st International Virtual Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding (VIPERC 2022)

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Abstract

This document introduces the 1st International Virtual Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding (VIPERC 2022), a premier forum for presenting the state-of-the-art, new research, ongoing work, academic and project reports in advanced statistics and machine learning, 3D modelling and simulation, knowledge representation, intelligent systems, information retrieval and software engineering, for visual pattern extraction, analysis and recognition to preserve the cultural heritage.

Keywords

Cultural heritage, Artificial Intelligence, Pattern recognition, Modelling and simulation.

1. Introduction

Cultural heritage is related to all the tangible and intangible aspects of historical, archaeological, architectural and artistic relevance. Each item of cultural heritage tells legends and traditions of people, families, communities and countries worldwide. Cultural heritage is a precious return to the society to find its origin and build the future from the past. It is a relevant part of everyday life, visible everywhere, from ruins of ancient places to modern natural scenes and art.

Tangible items of the cultural heritage include ancient buildings, archaeological sites, monuments, sculptures, paintings, coins, underwater ruins and cities, shipwrecks, manuscripts, photographs, films and other elements of artistic, archaeological, architectural and historical value. Intangible items can collect the acoustic heritage of ancient buildings, traditional crafts and festivals, oral traditions and expressions, dialects and sub-dialects, music, culinary traditions and ways of life.

The process of knowledge discovery and representation from the cultural heritage mainly consists of the extraction, recognition and modelling of visual patterns, which become of prior importance for the analysis and exploration of hidden features, new hypotheses, relationships,

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trends, and modes from the data of cultural heritage. A visual pattern refers to any characteristic which can be captured by the human senses.

Today partly, the extraction, recognition and modelling of visual patterns have been accomplished using simulation models, artificial intelligence, software computing, information retrieval and statistical analysis in multiple real-life contexts and scenarios.

From all aforementioned, the 1st International Virtual Conference on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding (VIPERC 2022) was intended to be an emerging forum for the dissemination of research in different areas such as image processing, artificial intelligence, software engineering, data mining and knowledge discovery, modelling and simulation. More specifically, VIPERC 2022 presented the state-of-the-art, new research and ongoing work in advanced statistics and machine learning, 3D modelling and simulation, knowledge representation, intelligent systems, information retrieval and software engineering, for visual pattern extraction, analysis and recognition to preserve the cultural heritage. It also proposed a stimulating environment for Industrial partners to exhibit, describe and promote innovation in products and services and to show their features from a scientific and technological sight, and their impact under an economical and society view in the field of cultural heritage.

2. Topics

Topics of interest included, but were not limited to:

- Machine learning and data science for cultural heritage multimedia data,
- Discrete geometry techniques for pattern recognition in cultural heritage images,
- Combinatorial pattern matching and discovery in ancient images,
- Graph-based methods for cultural heritage multimedia data,
- Signal processing in the cultural heritage,
- Intelligent systems for art restoration,
- Augmented and virtual reality systems,
- 3D reconstruction and model processing,
- 3D modelling and simulation of cultural heritage items,
- Classification or clustering of acoustic data from the cultural heritage,
- Image processing, texture and shape analysis in historical data,
- Computer vision for pattern extraction from cultural heritage images,
- Remote sensing for cultural heritage preservation,
- Data mining for historical language recognition,
- Image similarity and segmentation for the cultural heritage,
- Deep learning applied to cultural heritage multimedia data,
- Nature-inspired algorithms for historical multimedia data,
- Natural language processing in the cultural heritage,
- Knowledge representation and ontologies for ancient multimedia data,
- Historical document processing and classification,
- Speech, audio and music recognition and analysis from historical archives,

- Archiving and searching methods for cultural heritage multimedia data,
- Information retrieval in cultural heritage multimedia collections,
- Discrimination and recognition of ancient languages and dialects,
- Feature selection and extraction from cultural heritage multimedia data,
- Ensemble methods for visual understanding of cultural heritage,
- Industrial products, projects, prototypes and artefacts for cultural heritage preservation,
- Explainable AI for the recognition of ancient multimedia data.

3. Past VIPERC events

In the past, two VIPERC events were organized in the form of international workshops:

- The 1st International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 30 January 2019 in the CNR Area of Pisa, Pisa, Italy (VIPERC 2019[1]),
- The 2nd International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding, that was held on 29 January 2020 at the University of Bari Aldo Moro, Bari, Italy (VIPERC 2020[2]).

Both VIPERC 2019 and VIPERC 2020 were on site and co-located with the Italian Research Conference on Digital Libraries (IRCDL). Also, the book of Proceedings of both the events is available in CEUR-WS (Volumes 2320 and 2602).

The attendance rate of VIPERC events in previous years made it possible to offer VIPERC 2022 in the form of autonomous conference rather than a workshop co-located with a conference. Nevertheless, the Covid-19 pandemic situation at the time the conference was being organized has led several countries in the world to adopt restriction policies in the mobility of the population. This has led to difficulties in organizing face-to-face meetings, including scientific conferences and events. In order to accomplish to the rules by the authorities and ensure the safety of event attendees, it was decided to organize VIPERC 2022 as a virtual event.

4. Scientific Committee

The scientific relevance of the conference is assured by an international Organizing Committee which includes 20 researchers from 8 different countries worldwide (Italy, Bulgaria, Serbia, Pakistan, Greece, Brazil, Bosnia and Herzegovina, Sweden), and an international Program Committee which includes 23 researchers from 11 different countries worldwide (Italy, France, Bulgaria, Macedonia, Greece, South Africa, Bosnia and Herzegovina, Pakistan, Brazil, Russia, Serbia).

All the members of the Scientific Committee are recognised as experts in cultural heritage, knowledge representation and information retrieval, algorithms, pattern recognition, artificial intelligence, modelling and simulation methods.

[1] https://ircdl2019.isti.cnr.it/?page_id=537
[2] https://kdde.di.uniba.it/ircdl20/index.php/viperc-2020/

General Chairs:

- Alessia Amelio, Senior Researcher, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy,
- Sergio Montelpare, Full Professor, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy,
- Domenico Ursino, Full Professor, DII Marche Polytechnic University, Italy.

Publications Chairs:

- Gianluca Bonifazi, Research Fellow, DII Marche Polytechnic University, Italy,
- Giuseppe Brando, Associate Professor, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy,
- Guido Camata, Associate Professor, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy,
- Francesco Cauteruccio, Researcher, DII Marche Polytechnic University, Italy,
- Camilla Lops, Research Fellow, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy,
- Enrico Spacone, Full Professor, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy,
- Luca Virgili, Research Fellow, DII Marche Polytechnic University, Italy.

Publicity Chairs:

- Enrico Corradini, Research Fellow, DII Marche Polytechnic University, Italy,
- Michele Marchetti, Research Fellow, DII Marche Polytechnic University, Italy,
- Alessandro Ricciutelli, Research Fellow, InGeo University “G. d’Annunzio" Chieti-Pescara, Italy.

Local Chair:

- Gennady Agre, Assistant Professor, Institute of Information and Communication Technologies, Bulgaria.

International Relations Chairs:

- Nouman Ali, Associate Professor, Department of Software Engineering, Mirpur University of Science & Technology, Pakistan,
- Marijana Ćosović, Assistant Professor, Faculty of Electrical Engineering, University of East Sarajevo, Bosnia and Herzegovina,
- Anders Hast, Professor, Uppsala University, Sweden,
- Radmila Janković Babić, Research Assistant Professor, Mathematical Institute of the Serbian Academy of Sciences and Arts, Serbia,
- Katerina Kabassi, Professor and Vice Rector for Academic Affairs, International Relations and Extraversion, Department of Environment, Ionian University, Greece,
- Carlos Mello, Associate Professor, Center of Informatics, Federal University of Pernambuco, Brazil.

Program Committee:

- Paolo Barsocchi, First Researcher, ISTI-CNR of Pisa, Italy,
- Michelangelo Ceci, Full Professor, University of Bari Aldo Moro, Italy,
- Adrian-Gabriel Chifu, Associate Professor, Aix-Marseille University, France,
- Claudia Diamantini, Full Professor, Marche Polytechnic University, Italy,
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- Muhammad Sajid, Research Fellow, Mirpur University of Science & Technology, Pakistan,
- Dionisios Sotiropoulos, Assistant Professor, University of Piraeus, Greece,
- Una Stanković, Junior Research Assistant, Mathematical Institute of the Serbian Academy of Sciences and Arts, Serbia,
- Gian Piero Zarri, Research Associate, Sorbonne University, France.

5. Invited Speaker

VIPERC 2022 also included an invited talk from Dr. Radu Tudor Ionescu, Professor at University of Bucharest, Romania, and CTO of the SecurifAI Company[3], with title: “Shallow vs Deep Models for Dialect Identification". Dr. Ionescu is a well-reputed researcher in the fields of computer vision and pattern recognition, with more than 100 papers published in high ranked conference proceedings and journals, such as IEEE CVPR conference proceedings and IEEE Transactions on Pattern Analysis and Machine Intelligence.

[3] https://www.securif.ai/

5.1. Biography

Dr. Ionescu completed his PhD at the University of Bucharest in 2013. He received the 2014 Award for Outstanding Doctoral Research in the field of Computer Science from the Romanian Ad Astra Association. His research interests include machine learning, computer vision, image processing, medical imaging, computational linguistics and text mining. He published over 100 articles at international peer-reviewed conferences and journals, and a research monograph with Springer. He received the “Caianiello Best Young Paper Award" at ICIAP 2013 for the paper entitled “Kernels for Visual Words Histograms". Dr. Ionescu also received the “2017 Young Researchers in Science and Engineering" Prize for young Romanian researchers and the “Danubius Young Scientist Award 2018 for Romania" by the Austrian Federal Ministry of Education, Science and Research and by the Institute for the Danube Region and Central Europe. Together with other co-authors, he obtained good rankings at several international competitions: 4th place in the Facial Expression Recognition Challenge of WREPL 2013, 3rd place in the NLI Shared Task of BEA-8 2013, 2nd place in the ADI Shared Task of VarDial 2016, 1st place in the ADI Shared Task of VarDial 2017, 1st place in the NLI Shared Task of BEA-12 2017, 1st place in the ADI Shared Task of VarDial 2018.

5.2. Abstract

Following our participation in the VarDial evaluation campaigns on dialect identification since 2016, we have witnessed a head-to-head comparison of shallow and deep learning models over several years. Interestingly, it seems that, for the dialect identification task, deep learning models are seriously challenged by shallow methods based on low-level features, e.g. character n-grams. In this talk, we will review a series of successful dialect identification approaches, either based on engineered or deep features, discussing the benefits and the downsides of each method. At the end, we will present some takeaways for future research on dialect identification.

6. Outcomes

VIPERC 2022 was held in the morning of 12 September 2022, from 8:45 am to 1:20 pm (Italian time) in virtual form on the Microsoft Teams platform. The virtual event was recorded and made available through the VIPERC Youtube Channel[4] of the conference, after collecting the authorizations from all the speakers to freely spread their videos, voices and contents. Due to the virtual mode, attendance to the event was free of charge, but registration was required in any case.

Four members of the Scientific Committee, Dr. Camilla Lops, Dr. Alessia Amelio, Dr. Radmila Janković Babić and Prof. Katerina Kabassi, were connected from their respective institutional locations: (i) Pescara, Italy (Dr. Lops and Dr. Amelio), (ii) Belgrade, Serbia (Dr. Janković Babić), and (iv) Zakynthos, Greece (Prof. Kabassi). Dr. Amelio and Prof. Kabassi presented the welcome reception and the invited talk. Also, Dr. Amelio chaired the Session 1 of the conference, with title: Applications of Machine Learning and Deep Learning to the Cultural Heritage. Furthermore, Dr. Janković Babić chaired the Session 2 of the conference, with title: Modelling

[4] https://www.youtube.com/channel/UC2g0Z40HJ9Ig1-EC5vNqR9g

and Human-Computer Interaction in the Cultural Heritage. Finally, Dr. Lops supervised both the Sessions.

The conference received 14 submissions. They were reviewed by a total of 19 international research scholars of the Scientific Committee from 7 different countries: Italy, Serbia, Pakistan, Greece, Brazil, Bosnia and Herzegovina, Russia. Each submission was reviewed by at least 2 research scholars. The reviewers for each paper were selected from different institutions than the authors' institutions. Also, the reviewers should not be involved in co-authorship with the paper's authors.

The peer reviewing process was performed using the EasyChair system. Each paper was evaluated according to: (i) clarity, (ii) relevance of the topic, (iii) adopted methodology. The only papers with at least 2 acceptance scores, and any reject score, were definitively accepted. In the end, a total of 11 papers was established to be included in the book of Proceedings: 10 full papers and 1 short paper. The accepted papers were authored by 34 research scholars from 7 different countries and multiple institutions from each country: Pakistan, Bosnia and Herzegovina, Italy, Portugal, Algeria, Serbia, France.

The Session 1 of the conference included 6 presentations in the field of machine learning and deep learning applied to the cultural heritage. Also, the Session 2 of the conference included 5 presentations in the field of modelling and human-computer interaction for the cultural heritage. At the end, VIPERC 2022 hosted a total of 20 participants.

One month after the conference, 7 accepted papers with the highest ranking in the review process were selected. Then, their authors were invited to extend the contribution to the Topical Collection on Visual Pattern Recognition and Extraction for Cultural Heritage[5] in the Neural Computing and Applications journal, Springer, with an Impact Factor of 5.102 (2021), Q1 ranking in Software (Guest Editors: Prof. Domenico Ursino, Dr. Alessia Amelio, Dr. Francesco Cauteruccio, Prof. Sergio Montelpare, Prof. Francesco Carlo Morabito). Deadline for submitting the extended contributions is 31 December 2022. Currently, all the contacted authors accepted to provide an extended version of their work to the Topical Collection.

7. Program

- 8:45 am – 9:00 am: Welcome reception
- 9:00 am – 9:25 am + 5min Q&A: **Invited talk**: *Shallow vs Deep Models for Dialect Identification*, prof. Radu Ionescu, University of Bucharest and CTO of SecurifAI
- (9:30 am - 11:30 am) **Session 1: Applications of Machine Learning and Deep Learning to the Cultural Heritage** - Chair: Dr. Alessia Amelio
  - 9:30 am - 9:45 am + 5min Q&A: Hadj Mohammed Djamel and Nacéra Bensaou, *Abjad numerals recognition in medieval arabic mathematical texts*
  - 9:50 am – 10:05 am + 5min Q&A: Sehrish Manzoor, Nouman Ali, Muhammad Raees, Khan Awais Khan, Muhammad Usama Ayub and Afzal Ahmed, *Ancient coin classification based on recent trends of deep learning*

[5] https://www.springer.com/journal/521/updates/23330966

  - 10:10 am – 10:25 am + 5min Q&A: Pasquale Savino and Anna Tonazzini, *A shallow neural net with model-based learning for the virtual restoration of recto-verso manuscripts*
  - 10:30 am – 10:45 am + 5min Q&A: Radmila Janković Babić, *Cultural heritage image classification using transfer learning for feature extraction: a comparison*
  - 10:50 am – 11:05 am + 5min Q&A: Israr Ur Rehman, Zulfiqar Ali, Zahoor Jan, Muhammad Rashid and Waqar Ali, *Empirical performance analysis of classification methods on cultural heritage database*
  - 11:10 am – 11:25 am + 5min Q&A: Lorenzo Stacchio, Alessia Angeli, Giuseppe Lisanti and Gustavo Marfia, *Searching for cultural relationships through deep learning models*

- (11:30 am - 1:10 pm) **Session 2: Modelling and Human-Computer Interaction in the Cultural Heritage** - Chair: Dr. Radmila Janković Babić
  - 11:30 am – 11:45 am + 5min Q&A: Belma Ramić-Brkić and Marijana Ćosović, *Exploring digital tourism application for medieval period reconstruction*
  - 11:50 am – 12:05 pm + 5min Q&A: Marijana Ćosović and Mirjana Maksimović, *Application of the digital twin concept in cultural heritage*
  - 12:10 pm – 12:25 pm + 5min Q&A: Raquel Matos, Hugo Rodrigues, Aníbal Costa and Fernanda Rodrigues, *BIM-FM integrated solution resourcing to digital techniques*
  - 12:30 pm – 12:45 pm + 5min Q&A: Hafiz Abdul Basit Muhammad, Khalid Hamid, Muhammad Waseem Iqbal, Syed Khurram Shahzad, Farrukh Muneem and Muammad Shaheryar, *Usability impact of adaptive culture in smart phones*
  - 12:50 pm – 1:05 pm + 5min Q&A: Alessia Amelio and Gian Piero Zarri, *A knowledge representation framework for managing Leonardo Da Vinci's Mona Lisa: case study of the hidden painting*

- 1:10 pm – 1:20 pm: Closing

8. Acknowledgments

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