VIPERC 2020: Visual Pattern Extraction and Recognition for Cultural Heritage Understanding

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Abstract. Today partly, extraction, recognition and analysis of visual patterns have been accomplished using machine learning, deep learning, intelligent systems, software computing, information retrieval and statistical analysis in multiple real-life contexts and scenarios. The *2nd International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding* (VIPERC 2020) is intended to be an international forum whose main goal is presenting the advancement of the state-of-the-art, innovative research, ongoing work, academic and project reports in statistics and data mining, as well as applied mathematics, knowledge representation, intelligent systems, information retrieval and software engineering, for visual pattern extraction, analysis and recognition aiming to preserve the cultural heritage. The event was organised as an international research forum by the University of Calabria and the Uppsala University.

Keywords: Cultural heritage · Pattern recognition · Machine Learning · Artificial intelligence · Visual computing.

1 Background and Goals

Cultural heritage refers to all the tangible and intangible elements of public interest and historical, archaeological, social and artistic relevance. Each cultural heritage element captures stories and traditions of people, families, communities and countries worldwide. It represents a universal asset, to the society is need to remember an assistance, find itself, and to build the future from the past. Cultural heritage is embedded in multiple aspects of everyday life. Also, it is everywhere, spread in little towns and big cities, in natural scenes and archaeological sites. Tangible elements of the cultural heritage include paintings, sculptures, photographs, films, coins, manuscripts, monuments, archaeological sites, historical buildings, shipwrecks, underwater ruins and cities, and other different items of artistic, archaeological or historical value. Intangible elements promote the preservation of oral traditions and expressions, songs, culinary traditions, ways of life, dialects and sub-dialects, traditional crafts and festivals, culturally significant landscapes and biodiversity.

In order to understand the knowledge which is contained in the cultural heritage, the extraction and recognition of visual patterns represents a milestone for modelling, analysing and exploring meaningful characteristics, aspects, trends, and modes in the cultural heritage elements for advancing important hypotheses and revealing useful information. "Visual" is here to be understood in its broader meaning and refers to everything that can be concretely accessed with the human senses.

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The *2nd International Workshop on Visual Pattern Extraction and Recognition for Cultural Heritage Understanding* (VIPERC 2020) is intended to be an international forum whose main goal is presenting the advancement of the state-of-the-art, innovative research, ongoing work, academic and project reports in statistics and data mining, as well as applied mathematics, knowledge representation, intelligent systems, information retrieval and software engineering, for visual pattern extraction, analysis and recognition aiming to preserve the cultural heritage.

The workshop welcomes contributions from different research areas such as Computer Vision, Pattern Recognition, Artificial Intelligence, Software Engineering, Archaeometry and History. It is also proposed as a stimulating environment for exhibiting, presenting and promoting new technologies, products and services and to show their implementation from a scientific sight, and their impact under an economical and society perspective in the context of the cultural heritage.

2 Topics

The topics of interest of VIPERC 2020 included, but were not limited to:

- Neural networks for cultural heritage multimedia data
- Machine learning and data mining for cultural heritage classification
- Discrete geometry techniques for pattern recognition in cultural heritage images
- Combinatorial pattern matching and discovery in ancient findings
- Graph-based methods for cultural heritage data
- Signal processing in cultural heritage multimedia data
- Intelligent systems for art restoration
- Augmented and virtual reality systems
- 3D reconstruction and model processing
- Image processing, texture and shape analysis in historical data
- Computer vision for pattern extraction from cultural heritage images
- Remote sensing for cultural heritage preservation
- Statistical methods for historical language recognition
- Digital libraries

- Classification, similarity and segmentation of cultural heritage images
- Deep learning applied to cultural heritage multimedia data
- Nature-inspired algorithms for historical multimedia data
- Hardware-based solutions for pattern analysis in cultural heritage
- Knowledge representation and ontologies for cultural heritage understanding
- 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 findings
- Discrimination and recognition of ancient languages and dialects
- Content-based image retrieval for cultural heritage
- Feature extraction from cultural heritage multimedia data
- Software packages for cultural heritage understanding
- Industrial products, projects, prototypes and artefacts for cultural heritage preservation
- Biomedical aspects of cultural heritage

3   Outcomes

VIPERC 2020 was co-located with the *16th Italian Research Conference on Digital Libraries* (IRCDL 2020). The workshop was held in the afternoon of 29 January 2020 in Bari, Italy.

The workshop received 12 submissions. Each submission was reviewed by at least 2 scholars of the Scientific Committee. 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. 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 number of 6 papers were included in this book of Proceedings: 2 short papers and 4 full papers.

The papers were authored by 12 research scholars from 6 different countries and multiple institutions from each country:

- Italy,
- Bosnia and Herzegovina,
- Sweden,
- Serbia,
- Iraq,
- Australia.

Also, VIPERC 2020 hosted a total number of 20 participants.

4   Committee

The scientific relevance of the workshop is assured by an international Organising Committee which includes 10 research scholars from 3 different countries worldwide (Italy, Sweden and Greece), and an international Scientific Committee which includes 20 research scholars from 8 different countries worldwide (Greece, Italy, France, Pakistan, Germany, Spain, Norway, Sweden) and widely recognised as experts in cultural heritage, machine learning, pattern recognition, data analysis, artificial intelligence and visual computing.

Organising Committee

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5 Acknowledgments