InfoWare 2022
The Seventh International Conference on Applications and Systems of Visual Paradigms **VISUAL22**
May 22, 2022 to May 26, 2022 - Venice, Italy

A Collaborative Responsive and Fully Customizable System for Image Quality Assessment Based on Subjective Visual Perception

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About the speaker

Maria Grazia Albanesi is Associate Professor of Computer Science at Department of Electrical, Computer and Biomedical Engineering of the University of Pavia (Italy)

She graduated *cum laude* in 1986 at the Faculty of Engineering of Pavia with a thesis entitled “Visual perception and image compression”.

She received her PhD. in Electronic, Computer and Electrical Engineering in 1992 with a thesis entitled “Integrated VLSI architectures for signal and image processing”.

Her current research interests focus on (a) **signal and image analysis and understanding** for **image retrieval**, **image quality and similarity assessment**; and (b) **model definition and applications** for Computational Sustainability based on visual data.

Outline

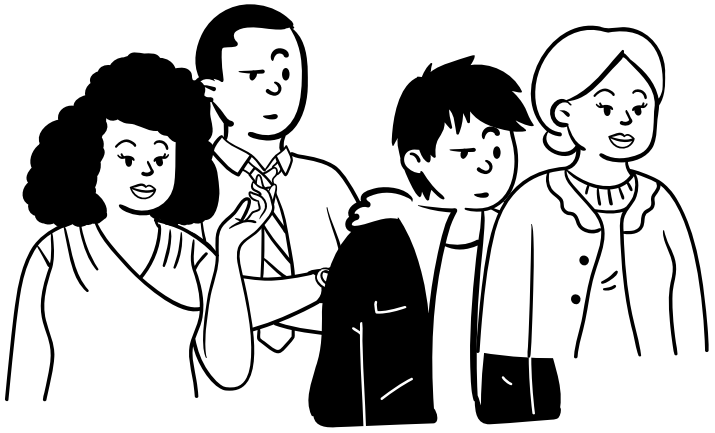
- The target problem: subjective image quality assessment
  - Traditional approach
  - Collaborative approach
- The developed system: SIQA
  - Innovations
  - **Offline** and **Live** methods
- Experiment Design and Analysis
- A visual tool for image/tester assessment: Visual MOS Tables
- Conclusion
- Future Work

Subjective image quality assessment: **Traditional** vs. crowdsourcing approach

There are two methods to assess image quality: objective and subjective approach

Subjective approach is the most reliable but also the most time and effort consuming

Traditional approach: It is realized by choosing a pool of observers (testers) who express a subjective opinion on a set of images, under controlled viewing conditions



Mean OS – Standard deviation of OS

Subjective image quality assessment: Traditional vs. **crowdsourcing** approach

It consists in recruiting observers on the Web and the realizations of the experiments using a Web-interface.

Advantages:

Cost reductions

Time efficiency

The recruitment phase of the observers can be delegated to another subject or using collaborative platforms, i.e., social networks

Disadvantage:

loss of the control over the choice of observers and the standardization of the method

The system here proposed is a **hybrid** system, as it can be used in both the two approaches (LIVE & OFFLINE)

The New System:
SIQA (SubjectIve Quality Assessment)

- SIQA is based on a Web interface for experimental evaluation of the perceived quality.

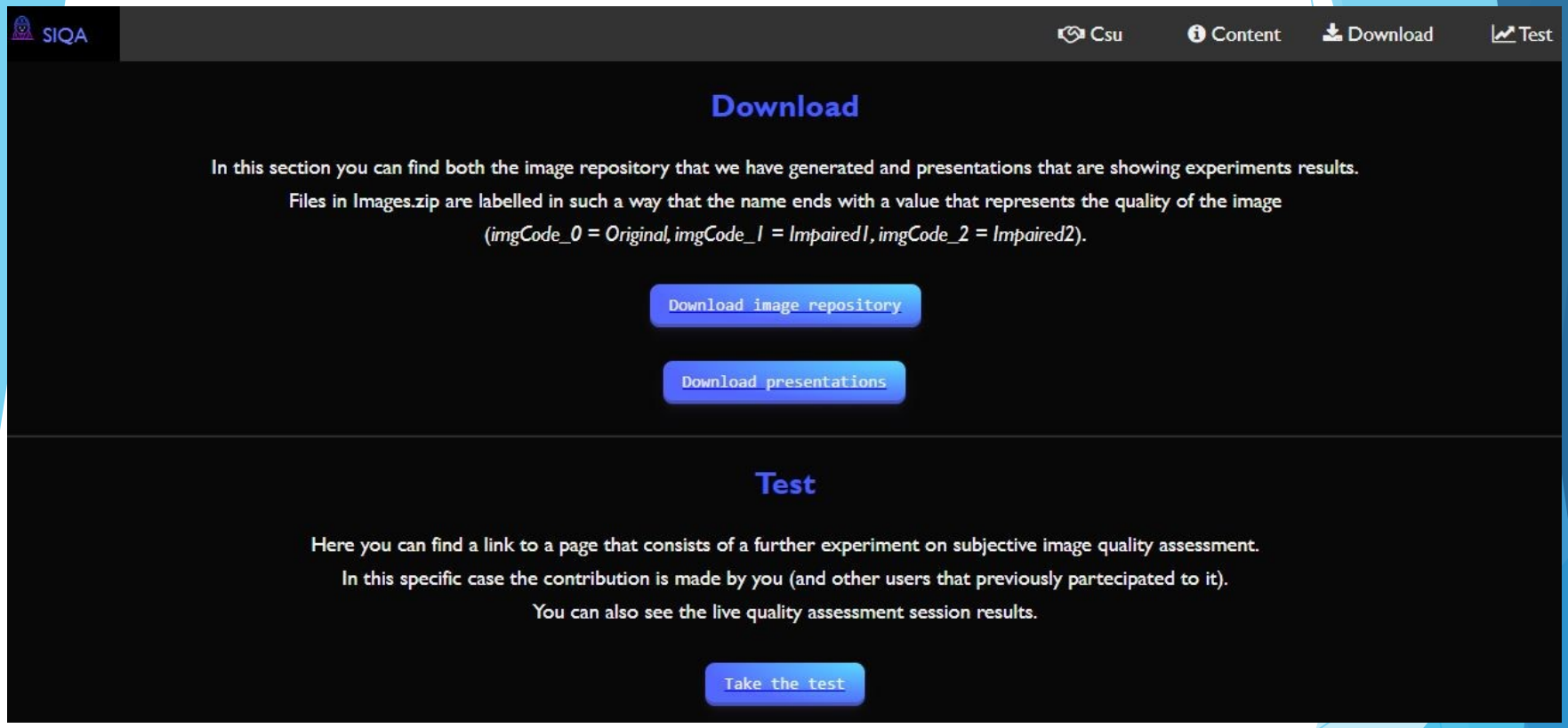
University of Pavia. *Subjective Image Quality Assessment.* [retrieved: May 2022]: https://siqa.pythonanywhere.com/
Fully responsive

- The possibility of downloading the entire project and installing a stand-alone configuration allows to use it also for the traditional approach

University of Pavia. *SIQA Software*. [retrieved: May 2022]: https://github.com/aiman-al-masoud/image_quality_assessment

Customization of the software

SIQA Website

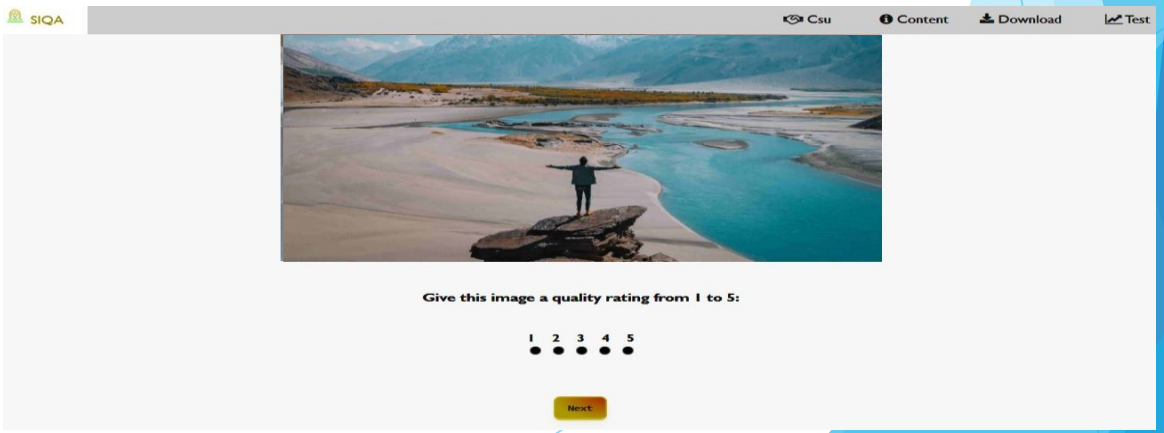


SIQA: Experiments

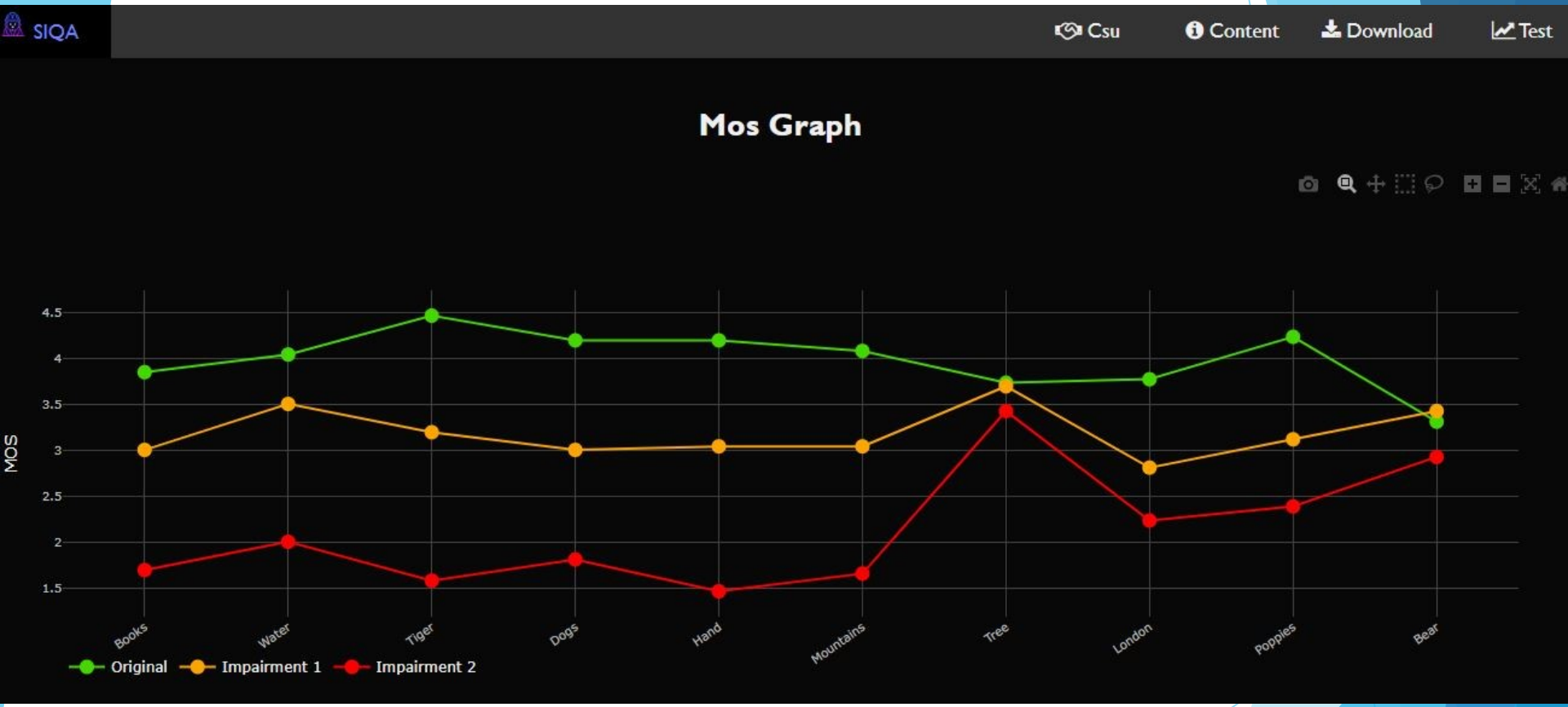
Live Test

Single stimulus Absolutely Category Rating (ACR) test

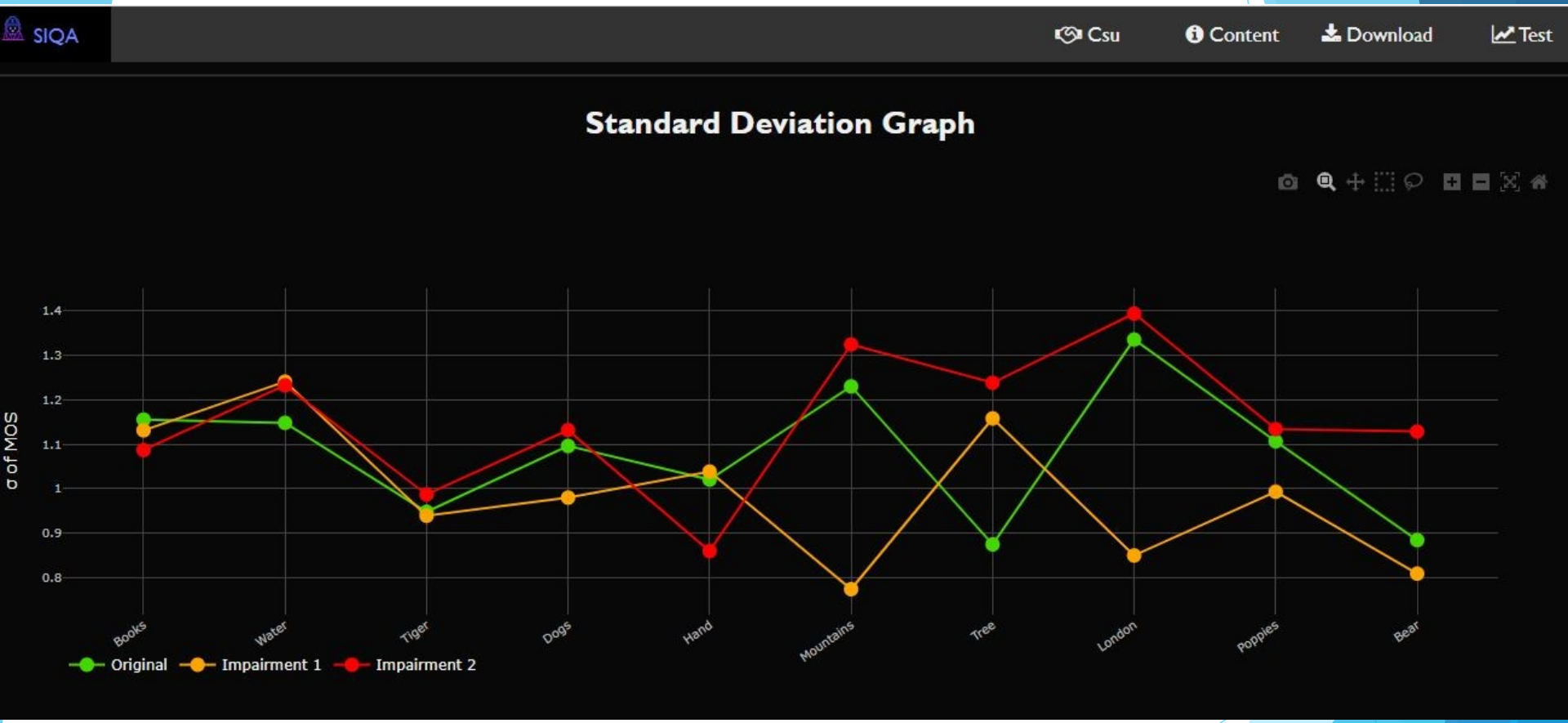
Instructions for viewing conditions



SIQA: Live experiments- Results (1/2)



SIQA: Experiments - Results (2/2)



SIQA: Subjective Quality Assessment

The Visual MOS Table

Experiments on the Offline method on 10 grey-level images of three levels of impairment


Image n. 1 – Wheel


Image n. 2- Boat


Image n. 3 – Rides


Image n. 4 – Wuhan


Image n. 5 - Guy


Image n. 6 – Beach


Image n. 7- Car


Image n. 8 – Pedestrian


Image n. 9 – Baby


Image n. 10 - Building

SIQA: Subjective Quality Assessment
The Visual MOS Table

A graphical and visual arrangement of the results

	Unimpaired images										Slightly impaired images										Highly impaired images									
	01 - Wheel	02 - Boat	03 - Rides	04 - Wuhan	05 - Guy	06 - Beach	07 - Car	08 - Pedestrians	09 - Baby	10 - Building	01 - Wheel	02 - Boat	03 - Rides	04 - Wuhan	05 - Guy	06 - Beach	07 - Car	08 - Pedestrians	09 - Baby	10 - Building	01 - Wheel	02 - Boat	03 - Rides	04 - Wuhan	05 - Guy	06 - Beach	07 - Car	08 - Pedestrians	09 - Baby	10 - Building
	"**Expert**" evaluators group																													
Evaluator No. 1	5	4	3	5	5	4	4	5	3	5	3	3	2	5	3	4	3	3	3	4	2	2	1	3	2	1	1	2	1	2
Evaluator No. 2	4	5	5	5	4	5	2	5	3	5	3	5	3	5	4	5	2	4	5	5	1	2	1	4	5	2	1	5	3	5
Evaluator No. 3	5	5	5	3	5	5	5	5	4	5	3	4	3	2	3	2	3	4	3	4	2	1	2	2	2	2	1	3	4	4
Evaluator No. 4	5	5	4	4	4	5	5	5	4	3	3	5	2	2	2	4	4	3	2	3	1	1	1	3	1	2	1	1	2	2
Evaluator No. 5	5	5	5	5	5	5	5	5	3	5	2	5	3	3	5	3	4	5	5	3	1	1	1	3	3	1	1	3	4	1
Evaluator No. 6	3	4	5	4	4	4	5	5	5	4	3	3	2	3	3	3	3	3	3	3	2	2	2	2	2	2	1	2	2	2
Evaluator No. 7	5	5	5	3	4	4	4	5	4	3	2	3	2	2	2	1	2	3	3	3	1	1	1	2	1	1	1	1	1	1
Evaluator No. 8	2	4	5	5	4	3	5	4	5	4	2	2	2	3	2	2	3	3	4	2	1	1	1	1	1	1	1	2	1	1
Evaluator No. 9	5	4	5	1	5	5	1	5	5	4	3	4	2	3	4	2	3	2	3	3	3	2	1	5	1	2	1	1	2	1
Evaluator No. 10	5	4	4	3	4	4	5	4	4	3	2	3	2	4	3	3	3	3	4	3	1	1	1	2	2	1	1	2	2	2
Evaluator No. 11	5	5	5	4	5	5	4	5	5	3	3	3	3	3	2	3	3	3	3	4	1	1	1	3	1	2	1	2	2	3
Evaluator No. 12	5	5	5	4	5	4	5	5	5	5	4	5	4	5	4	4	5	5	5	4	2	2	2	5	5	2	3	4	4	5
Evaluator No. 13	5	4	3	3	3	4	3	4	3	4	2	2	2	2	2	2	2	3	2	2	1	2	2	2	1	1	1	1	1	2
SD of MOS for "**Expert**" evaluators group	1,0	0,5	0,8	1,2	0,7	0,7	1,3	0,4	0,9	0,9	0,6	1,1	0,7	1,2	1,0	1,1	0,9	0,9	1,1	0,9	0,7	0,5	0,5	1,2	1,4	0,5	0,6	1,2	1,2	1,4
	"**Non-expert**" evaluators group																													
Evaluator No. 14	3	4	5	5	2	3	5	4	3	5	4	4	4	4	3	3	4	2	3	3	3	4	2	3	1	2	2	3	2	4
Evaluator No. 15	4	4	4	5	4	4	5	5	5	4	5	2	2	3	3	3	3	4	4	5	1	1	1	3	1	1	1	3	3	3
Evaluator No. 16	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5
Evaluator No. 17	4	4	4	5	4	3	5	5	4	4	4	4	4	3	4	4	2	4	3	5	3	2	1	2	1	1	2	1	2	2
Evaluator No. 18	4	4	4	3	4	3	3	3	4	4	3	3	2	1	2	2	1	3	3	4	1	1	2	2	1	1	1	2	2	1
Evaluator No. 19	5	5	3	4	5	3	4	3	3	2	3	4	2	3	4	3	3	4	2	4	2	2	1	3	2	2	1	2	2	2
Evaluator No. 20	5	5	5	5	5	5	5	5	5	5	4	3	3	5	4	3	3	3	3	3	1	1	1	3	1	1	2	3	3	1
Evaluator No. 21	3	3	3	4	4	3	3	4	4	3	2	2	2	3	2	2	3	3	3	2	1	1	1	2	1	1	2	1	2	2
SD of MOS for "**Non-expert**" evaluators group	0,8	0,7	0,8	0,8	1,0	0,9	0,9	0,8	0,8	1,1	1,0	1,1	1,2	1,3	1,1	1,0	1,2	0,7	0,9	1,1	1,5	1,6	1,4	1,0	1,4	1,4	1,3	1,1	1,1	1,4
Global SD of MOS	0,9	0,6	0,8	1,1	0,8	0,8	1,2	0,7	0,8	0,9	0,9	1,1	0,9	1,2	1,0	1,0	1,0	0,8	1,0	1,0	1,1	1,1	0,9	1,1	1,4	0,9	1,0	1,1	1,1	1,4
	0,9										1,0										1,2									

Conclusion and future works

- The hybrid system SIQA for subjective image quality assessment based on the classical single stimulus ACR method has been presented
- Experiments has shown its efficacy in both traditional and crowdsourcing approach.
- An innovative visual tool (Visual MOS Table) has been also described for the analysis of MOS experimental data, for finding outliers
    - in the image set or
    - in the human observer group

Future work will try to adapt the SIQA system to:
(a) evaluation of video quality
(b) to rehabilitation of patients with cognitive deficits by enlarging the concept of “quality” also to a semantic interpretation of the image content.

Thank you very much for your attention!

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ACKNOWLEDGMENT

The author would like to thank very much the following computer engineers of the staff of the Digital Content Retrieval Lab (University of Pavia) for the collection of the images and the deployment on the Web of the system and of the downloadable code: A. Al Masoud, F. Amato, A. S. Blindu, M. Bottini, D. P. Lotito, F. Marinelli, D. Murer, R. Petri, and F. Tagliani.