

**Title :**

3D Image quality assessment

**Advisors :**

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**Advisors short bio :**

Pr. **Luce Morin** is a full professor at the National Institute of Applied Sciences (INSA) of Rennes, France. She received the M.S. degree from ENSPS school in Strasbourg in 1989. She spent a 6 month end-of-study internship at the NASA Goddard Space Flight Center, Washington, DC. She then was a PhD student at the LIFIA laboratory, working under the supervision of Prof. R. Mohr on projective invariants applied to computer vision. From 1993 to 2008 she was an assistant professor at University of Rennes and a member of the Temics team at IRISA/INRIA-Rennes laboratory. She is now a professor at INSA-Rennes, where she teaches computer science, image processing, and computer vision. She is a member of the Institute of Electronics and Telecommunications of Rennes (IETR), UMR CNRS 6164. Her research activities deal with 3-D modelization from video sequences and 3D video compression. She has supervised or co-supervised 14 PhD students.

She is the co-author of 5 book chapters and more than 60 scientific papers. She is a reviewer for international conferences and journals such as Image communication, TVCJ, IEEE-PCS, IEEE-MMSP, ICCV, EUSIPCO.

She has also serves as an expert for the ANR French National Agency for Research.

L. Morin has been involved in several national and international research projects: RNRT-V2NET on interactive video over networks, ARC-Telegeo on compression of 3D meshes, European Network of Excellence SIMILAR, FUTURIM@GE on future formats for TV, FUI-RUBI3 on urban modeling, ANR-PERSEE on perceptual video coding.

Dr **Lu ZHANG** is an associate professor at the National Institute of Applied Sciences (INSA) of Rennes, France. She is also a member of the Institute of Electronics and Telecommunications of Rennes (IETR), UMR CNRS 6164. She received the M.S. degree from Shanghai Jiaotong University in 2007. Then she participated in the Engineering Leadership Program (ELP) in National Instruments (NI) at Shanghai for two years. From October 2009 to November 2012, she was a PhD student at the University of Angers, and at laboratories LISA (renamed as LARIS now) and IRCCyN (renamed as LS2N now) in France. Her thesis topic was "Numerical observers for the objective quality assessment of medical images". Then she worked on the Quality of Experience (QoE) in Telemedicine as a research engineer before she joined INSA and IETR in September 2013.

Her PhD thesis was awarded (in french, “prix de thèse”) by IEEE France Section, SFGBM, AGBM and GdR CNRS-Inserm Stic-Santé.

Since 2010, Dr. Lu ZHANG is the co-author of 7 international journal papers, 26 international conference papers and 5 french conference papers. She co-supervised 6 PhD students since 2015, one of them has already got her PhD degree in February 2018. Dr. Lu ZHANG became a member of the Video Quality Experts Group (VQEG) in 2013. She was an invited speaker at the 6th Qualinet General Meeting. She was invited to give seminars by several chinese universities or research institutes several times. She co-chaired the special session on “Quality Assessment for Medical Imaging Applications” in QoMEX 2018. She is the project leader of an ANR (France National Agency for Research) ASTRID (Specific Support for Defence Research Projects and Innovation) project from 2018 to 2020.

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### Thesis topic :

Recent studies in 3D technology led to a growing development in 3D applications. Nowadays, the new highly advanced multimedia video systems, such as 3D television (3DTV), 3D cinemas and free viewpoint television (FTV), provide a depth perception for the viewers, on both large TV screens and mobile phones and allow them freely navigate within a real world scene. Auto-stereoscopic systems provide 3D viewing experience without special glasses or other headgear, rely on depth information to synthesize intermediate views at an arbitrary view point.

Nowadays, massive effort has been put into research in stereoscopic 3D video coding and transmission technologies. In order to analyze and to compare the performance of numerous proposed technologies, 3D video quality assessment has become an important research topic.

This new topic has started to draw more attentions from 2011. While ITU has provided a recommendation for the subjective assessment of stereoscopic video, the subjective method for auto-stereoscopic video and the objective assessment of 3D videos are still **an open issue**. The main reason is that the quality metrics currently involved in the 3D coding context are the same as the quality metrics usually used for 2D video coding (PSNR, SSIM), whereas 3D video induces new types of perception, and also new types of distortion. Indeed, synthesized view quality will be significantly dependent on the spatial matching between the objects in the depth image and the texture image (i.e. the regular 2D video) : typically, a spatial shift of the depth information will create artifacts around edges in the synthesized intermediate view. That is why recent research highlights the influence of depth-image coding and its implications on the quality of video plus depth virtual view rendering.

Our previous works proposed new full-reference and no-reference quality assessment metrics which had good performances on the IRCCyN IVC DIBR Images quality database [1-4]. Then we constructed a new database without “old-fashion” artefacts, on which all the existing metrics perform not well (to be published).

The objective of this PhD work is to further explore the features of the distortions in the 3D images to propose new quality metrics with good performance on the new database, as well as to extend the metric to DIBR **video** quality assessment.

**References:**

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- [2] S. Tian, L. Zhang, L. Morin, O. Deforges. “Performance comparison of objective metrics on free-viewpoint videos with different depth coding algorithms”. SPIE Optical Engineering + Applications, August 2018, San Diego, California, USA.
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- [4] S. Tian, L. Zhang, L. Morin, O. Deforges. “NIQSV: A No Reference Image Quality Assessment Metric for 3D Synthesized Views”. ICASSP, March 2017, New Orleans, USA.