ENHANCED SUPER-RESOLUTION FOR MEDICAL DIAGNOSIS

González Villanueva L., M. Callicó G., Tobajas F. – IUMA, ULPGC, Spain
lara.villanueva@henesis.eu, {gustavo, tobajas}@iuma.ulpgc.es

ICVSS 2010
Registration and Video Analysis

Abstract

Nowadays, images are employed in several areas of medicine for early diagnosis. However, images related to pathological anatomy present in many situations poor quality, which complicates the diagnostic process. This work is focused on the **quality enhancement** of this type of images through a system based on **super-resolution techniques**. The results show that the proposed methodology can help medical specialists in the diagnostic of several pathologies.

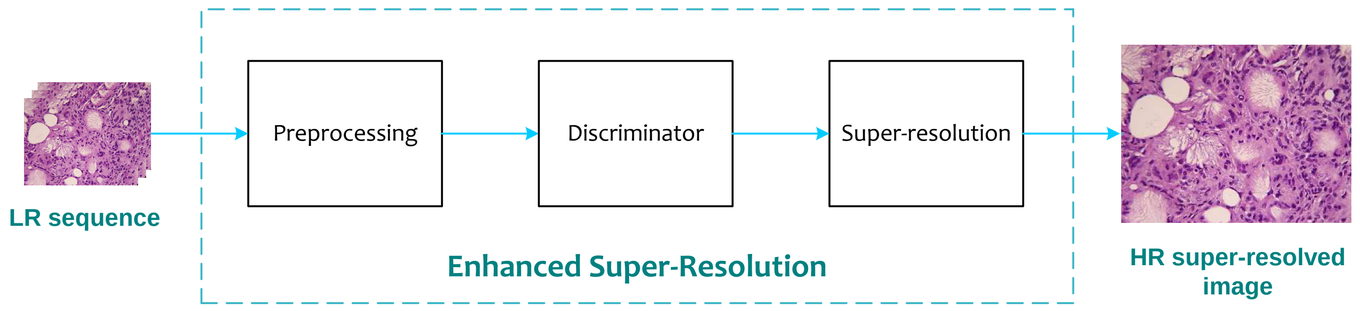
Introduction

In medicine, **quality**, understood as the ability to distinguish details in images, is fundamental, as it influences the analysis and the **detection of several pathologies**.

Super-Resolution (**SR**) algorithms are an interesting way to increase the resolution of images. They are based on the fact that, by combining various Low Resolution (LR) and highly correlated images, it is possible to obtain a High Resolution image (HR) by using the information contained in different images.

ESR

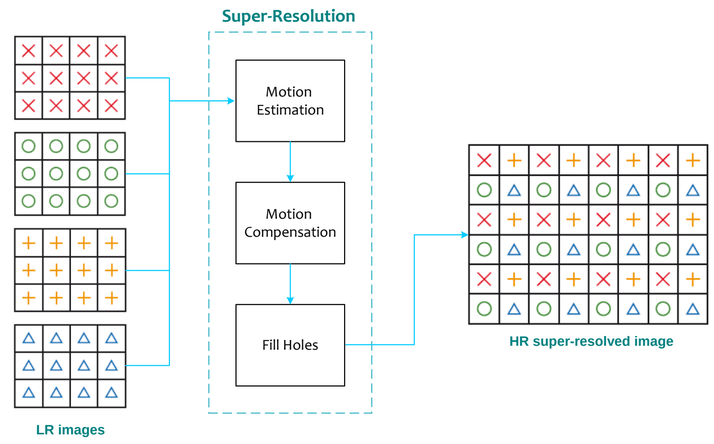
In this work, a system, named ***Enhanced Super-Resolution***, consisting on three functional modules, has been developed.



- **Preprocessing** consists on a set of image preprocessing steps and allows the adequacy of the images characteristics to the subsequent processes.

- The **Discriminator** module permits to discard those images whose motion is greater than a determined threshold, providing a highly correlated sequence.

- The **Super-Resolution** module consists on different stages and provides a super-resolved image with HR.



Conclusions

Considering both objective and subjective results, further supported by medical specialists, it can be stated that **it is possible to contribute to the medical field with important benefits thanks to the application of the proposed ESR system**.

Main references

[1] H. Greenspan, "Super-Resolution in Medical Imaging", in *The Computer Journal*, 2009 52(1):43–63.

[2] D. Kouam and M. Ploquin, "Super-resolution in medical imaging: An illustrative approach through ultrasound", in *IEEE International Symposium on Biomedical Imaging: From Nano to Macro*, pp. 249–252, 2009.

[3] G. M. Callicó, "Real-Time and Low-Cost Super-Resolution Algorithms onto Hybrid Video Encoders", *PhD Thesis*, University of Las Palmas de Gran Canaria, Spain, 2003.

[4] G. M. Callicó, S. López, O. Sosa, J. F. López and R. Sarmiento, "Analysis of fast block matching motion estimation algorithms for video Super-Resolution systems", IEEE Transactions on Consumer Electronics, vol. 54, issue 3, 1430 – 1438, 2008.

Acknowledgements

The authors would like to thank medical specialists from "Complejo Hospitalario Universitario Insular Materno-Infantil" and "Hospital Dr. Negrín de Gran Canaria" for their valuable contributions to this work.

Results

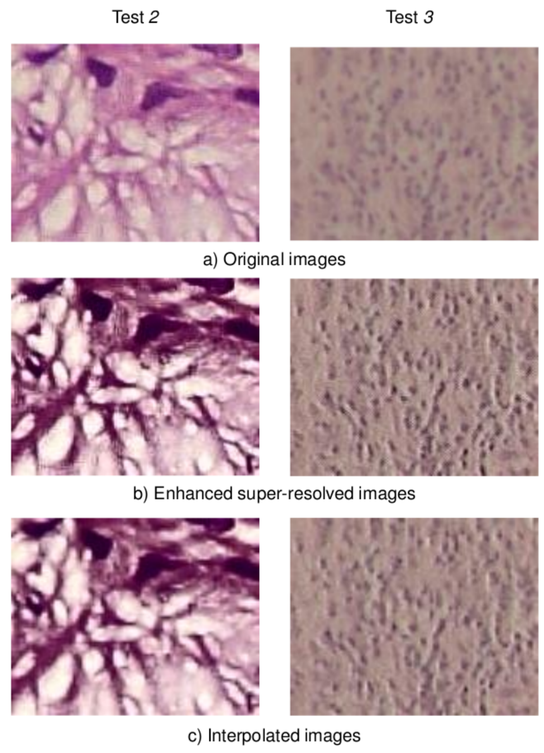
Objective results with different datasets

Test	PSNR SR	PSNR Int	Δ PSNR
1	55.20 dB	33.65 dB	21.55 dB
2	64.17 dB	25.97 dB	38.20 dB
3	70.06 dB	28.84 dB	41.22 dB
4	68.93 dB	33.49 dB	35.44 dB

Subjective results in different scenarios

Scenario	Validation rate
A	97.50 %
B	97.86 %
C	100.00 %

- **A**: 20 people (different ages and display equipment)
- **B**: 35 people (same lighting conditions and equipment)
- **C**: Pathological anatomy medical specialists



Comparison between original, enhanced super-resolved and interpolated images