

Problem 2 : Compress but careful !

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1 Statement

The pre-screening phase of all students groups is now over, and your group has been selected as a candidate to contribute to the first part of the *information engineering* work packages, namely, *image compression*.

Through previous Mars exploration missions in which ISAE was involved, the In'Sight mission for instance, the image processing experts of ISAE have gained a good understanding of the best compression scheme to be used. The candidate image compression scheme is a simplified and lightweight version of JPEG, named JPEG-L, which turns out to allow for good performances and low latency. The research team working on this project have already started the implementation of the solution and your task while joining them will be to complete the algorithm and assess its performances.

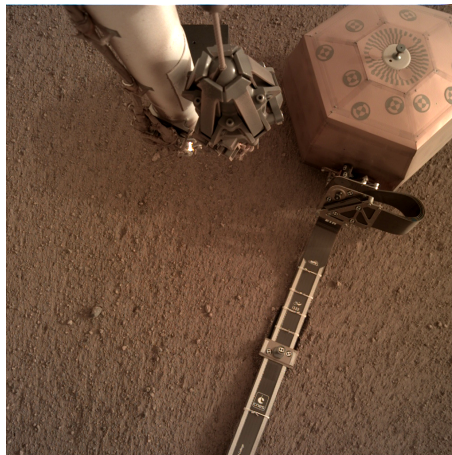


FIGURE 1 – Sample of an image taken on Mars

A few words about the work package specifications.

- Although JPEG is a lossy compression scheme through its lossy quantization step, it involves as well a lossless compression scheme (entropy coding), namely, Huffman coding. Both components contribute the compression of the image.

- Since the ISAE is the main contributor for this compression scheme, it wishes for its logo to be clearly visible on the compressed images. An example of the logo on Mars (from the In'Sight mission) is given in the figure below



FIGURE 2 – ISAE's logo on Mars (zoom on Figure 1)

Your assignment in the work package is as follows. You are given a python code which contains the research team progress on the JPEG.

- Implement and assess the performances of the entropy code (Huffman code)
- Find the best quantization factor Q which would allow the logo of ISAE to be visible on the obtained images
- Compute the compression ratio of JPEG-L

You will need to prepare a few slides to present your work, emphasizing the methodology you used to solve the problem and a critical analysis of your work.

2 References

For this problem, you can rely (not exclusively) on the following references

- Textbook on lossless compression
- Documentation on JPEG-L developed by ISAE
- Problem Based Learning : Learners guidelines (webpage of the course)

3 Working material

- The python code for JPEG-L
- The python code for a set of Huffman and JPEG-L related functions
- An RGB color image which contains the logo of ISAE