MASTER TSI 2 UNIVERSITE PAUL SABATIER
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The 2D discrete convolution

The 2D discrete convolution is an extension of the 1D discrete convolution but the convolution is done both horizontally and vertically in a 2D spatial domain. These calculations are used in the image processing domain. For example you can smooth an image, make it net or detect different boundaries within the image.

The 2D discrete convolution equation can be written as:

$$y(m, n)=\sum_{k}\sum_{l} x(m-k, n-l)\, h(k,l)$$

In this case the function h (called kernel) is centered which means the central point of h is h[0,0] and x is the 2D image.

1) Use a satellite image from internet (made in the Visible)

- Remind the convolution theorem and use the most efficient way to calculate the convolution of an image.

- Take h as a Gaussian (see next equation) and calculate the 2D convolution. The Gaussian is defined as:

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h[k,l]=exp(-(n1[k]**2+n2[l]**2)/(2*sigma**2));
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- Change the sigma parameter and conclude.
- Try different kernels given during the class. Explain why a kernel h can blurry the image?
- Try different images you can download from internet. Conclusions.

** Ask for a Python script (with gaps) to the teacher, if it is too hard (-: