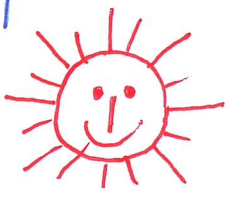
- Questions 1(a)–1(f) ...

  Discussed several times during the course, and the HELP on PREVIOUS YEARS' EXAMS.

- Question 2(a) ...

  Discussed during the Image Compression II lecture. See also One of the Exams in 2008/2009: Questions 3(c) and 3(d), discussed during the HELP on PREVIOUS YEARS' EXAMS.

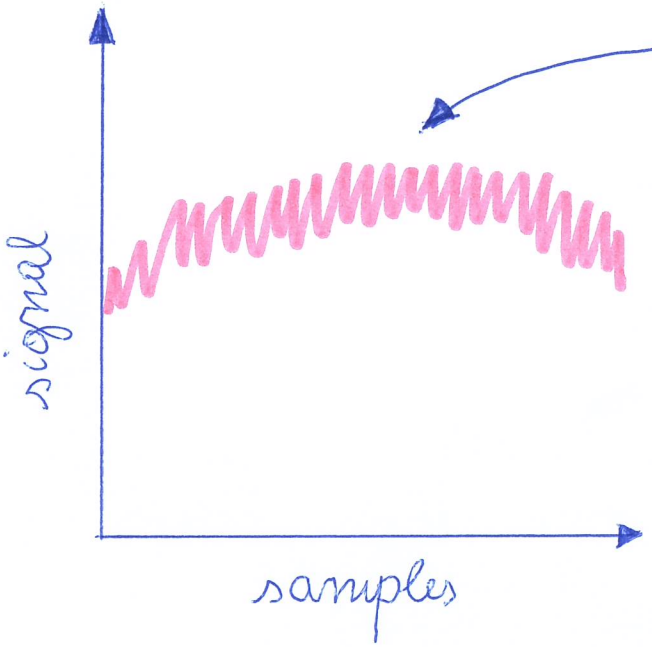
- Question 2(b) ...

  I am sure you are able to draw such a simple and beautiful picture. Let me dream about the scene instead 

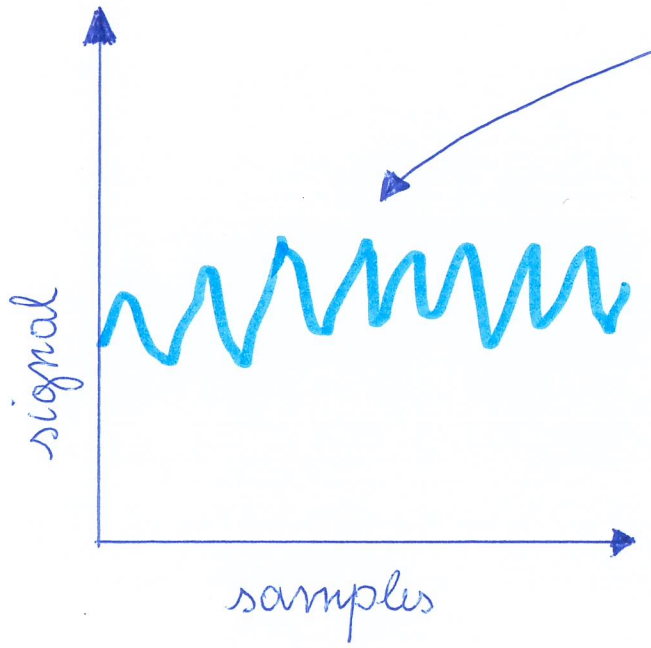
- Question 2(b): (1) ...

The KEY to the solution of this problem:

The colours of an image have nothing to do with "the colours of noise"!



A cross section of the sun:
pinkish, with
"blue" = high-frequency noise



A cross section of the sky:
bluish, with
"pink" = low-frequency noise

- Question 2(b): (2) ...

The KEY to the solution of this problem:

The frequencies that give colour to light * are orders of magnitude larger than the highest frequency that can be represented in an image** !

Unless the image represents a microscopic phenomenon !!

LIGHT

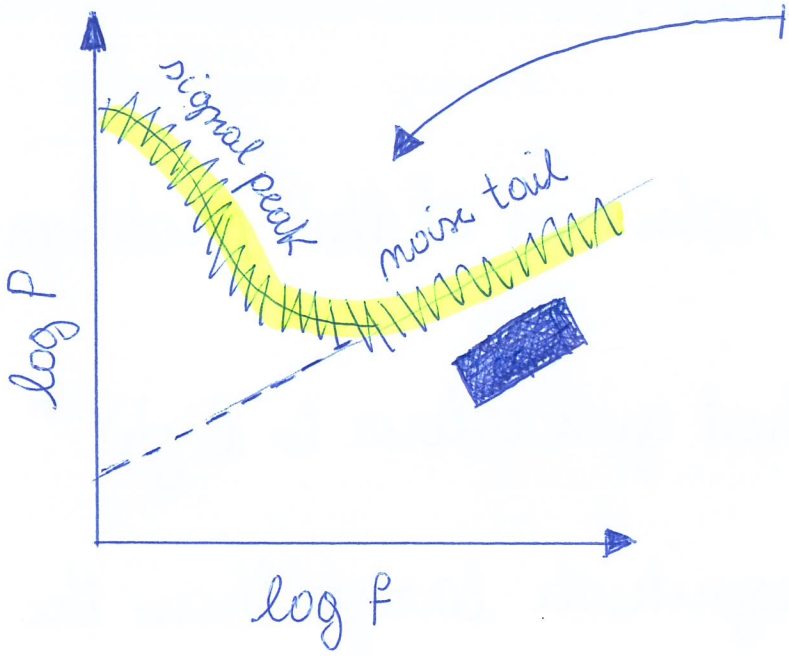
* wavelength $\lambda = 4\text{-}7 \times 10^{-4}$ mm →

spatial frequency $f \sim 1/\lambda \sim \underline{10^{3}}$ mm^{-1}

EXAMPLE

** spatial scale $s \sim 1$ mm →

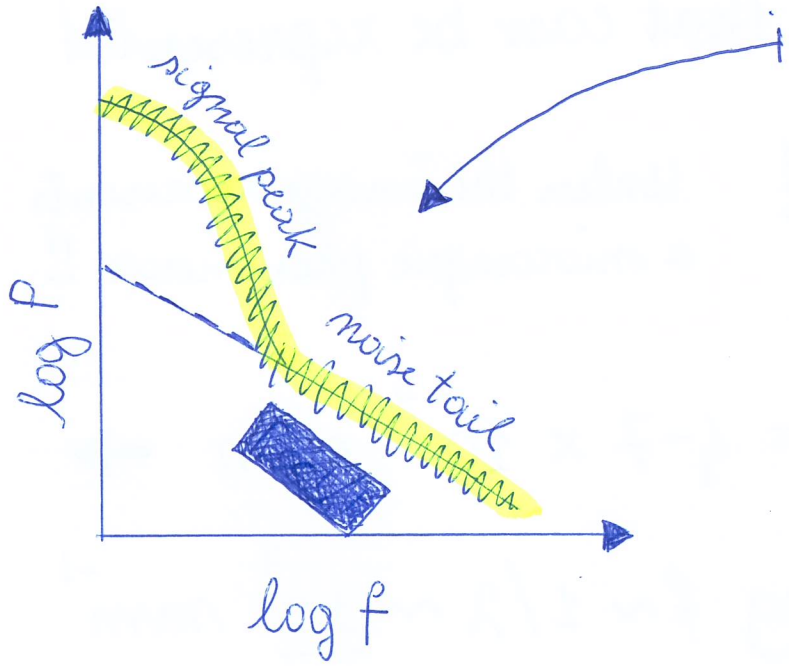
spatial frequency $f \sim 1/s \sim \underline{1}$ mm^{-1}



Fourier power spectrum of a cross section of the sun:

signal +

blue noise ($\langle P \rangle \propto f$)



Fourier power spectrum of a cross section of the sky:

signal +

pink noise ($\langle P \rangle \propto 1/f$)

- Question 2 (b): (3)...

The KEY to the solution of this problem:

Which transform allows us to do all that?

And in one go?? The fast wavelet transform!!!

This is similar to One of the Exams in 2011/2012: Question 1 (e), but there are three differences:

(A) The objects to denoise are two (sun, sky), rather than one (frame). This is not a problem you know where they are!

(B) The noise that pollutes such objects is coloured (blue, pink), rather than white. This is not a problem either: see One of the Exams in 2010/2011: Question 1 (e)!

(c) The shape of such objects is not rectangular, so it is less clear how to choose the level of the FWT. This will generate artifacts --- Discuss!

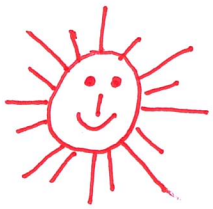
- Question 2(c) ...

This is the only exam question where you are allowed to "copy", at least in part!

The rest of the answer is also simple if you have understood the FWT in 2D.

But there is a subtle point ...

- Question 3(a) ...

This has always been your choice 

But answer thoroughly if you want to get full points!