**Some notes about detecting peaks in fast-sampling CO2 concentration signals**

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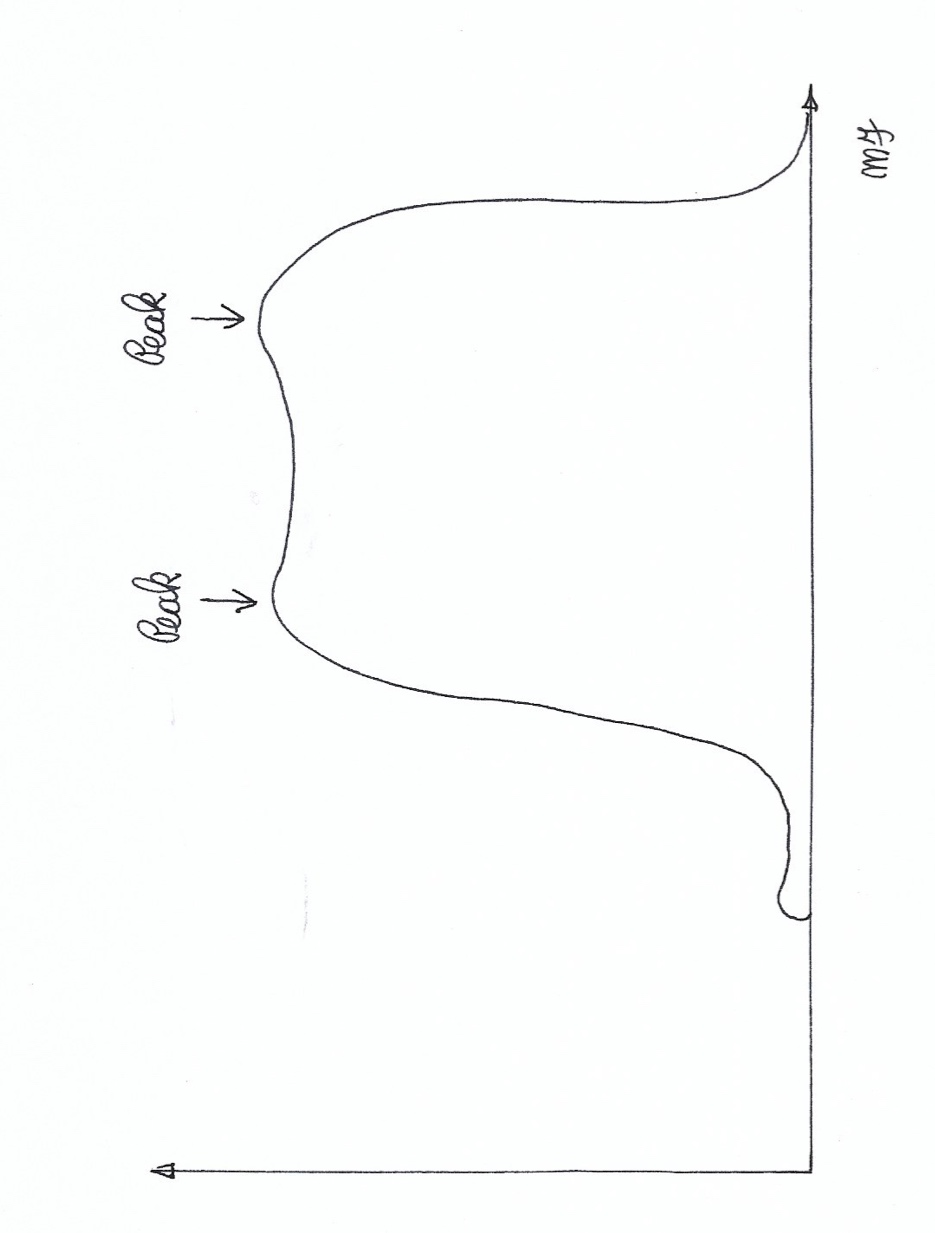
**1.Introduction**

What a *peak* is?

The question looks quite obvious, and the answer trivial. Of course, a peak is a peak, and very few of us would found this tautology offensive.

After all, the concept of a peak is so ingrained in our perceptual systems, that we all possess our personal “definition”, maybe just in terms of some neural circuit in our visual cortex. So deeply buried in the immense haystack of all others basic neural circuits, that defining a “peak” in words may even feel difficult to some people.

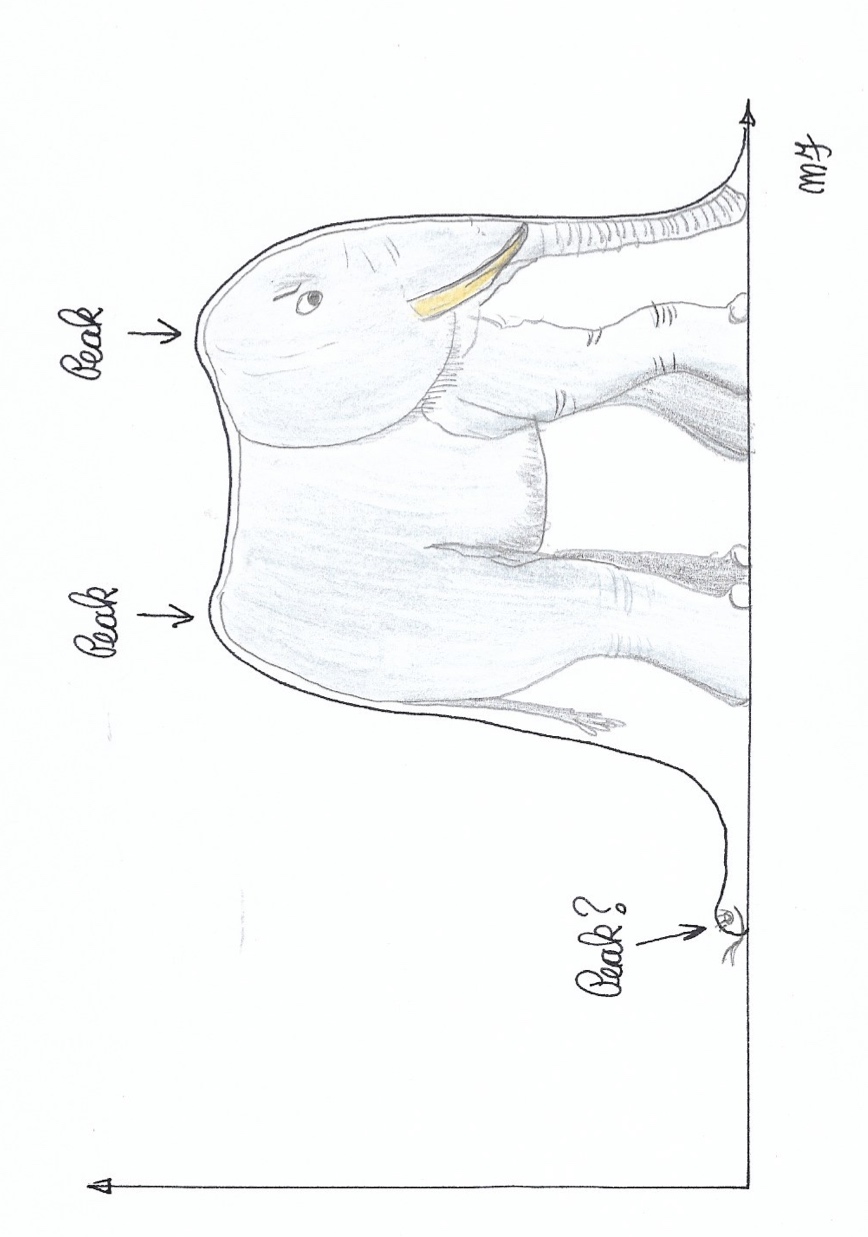
Maybe, in cases like this an inductive approach is easier to get. So, let’s start with a famous example:



Little question two peaks exist in this case (I’ve marked them). Although more a curve than the graph of a real-valued function, the plot exhibit changes above a smooth appearance, and due to these changes up and downs appear. Two ups look upper than others, and stand visually, to the extent to be very good peak candidates.

At least, as far as *I* am involved: having not yet defined exactly what a peak is, a large margin exists to subjectivity and taste.

From time ti time, it happens we can “see through things” and, for example, build a model for the phenomenon at stake, as A. de Saint Exupery surely made with his beautiful explain of our curve:



We all can understand the elephant’s disappointment – and the snake’s (surely a python given the mostly-mathematical contents of these notes) happiness. But our added knowledge carries also with it a dose of complication, and we may decide some minor features of our curve, in particular the snake’s head top, are also peaks. This is quite perceptual, in my feeling: would we have known for sure the python trying to digest the elephant was in reality a hat, I guess I’d been content with two, not three peaks.

But in fact, what characterizes a peak? Not really its absolute magnitude, otherwise we’d have to label only one peak, the rightmost, just above the elephant’s head.

Maybe, a better something could be a peak being somewhat above the “usual” level of the curve, being well aware this level may (as in our case) change quite importantly.

This looks intuitive, but, it’s also quite a dire requirement: to apply it, we should make sure in advance the curve has one, or many, “usual” levels. Of course, not all natural signals look this way, as we may see in the following figure.

