Sniffing for Meaning:
Defining and maximizing the signal-to-nose ratio

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Abstract

There are a great many papers and studies which make reference to a signal-to-nose ratio. [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] However, there are very few resources that explain what a signal-to-nose ratio is and how to optimize it. This paper will remedy that by examining references to the signal-to-nose ratio in existing work and exploring methods of maximizing the signal-to-nose ratio, which seems to be a good thing.

Defining Signal-to-Nose Ratio

Perhaps the closest we have to a concrete definition of the signal-to-nose ratio comes from "Magnetobiology: Underlying Physical Problems" by Vladimir N. Binhi. The book contains the following excerpt:

"The authors introduce a signal-to-nose ratio R as the ratio of the amplitude of a discrete component to the intensity of the continuous spectrum in a certain narrow frequency interval Δf of the discriminator near f_s." [2]

There is much insight to glean from this snippet of text. First, we now know that the signal part of the ratio is a "discrete component". This is disappointing to learn; if it exercises enough discretion, we may never find it. Luckily, we are given crucial information about the nose portion of the ratio. It is "in a certain narrow frequency interval Δf of the discriminator near f_s" (note: Δf is pronounced "nose eff" and f_s is simply pronounced "face"). This is useful information; it indicates that the nose portion of the ratio is related to the nose on one's face, rather than the nose of an airplane or a rocket.

Next, we examine Cvijetic and Djordjevic's "Advanced Optical Communication Systems and Networks":

"Generally, the signal and nose levels are defined in different ways in electrical and optical domains. The electrical signals are represented either by current or voltage amplitudes..." [6]

This tells us that the signals that we are looking for are *electrical signals*, like the ones that come from a mobile phone. This is rather handy because, as we know, signal is measured in "bars" which is a *discrete* measure! It seems that Dr. Binhi was making gratuitous use of wordplay when writing on the subject.

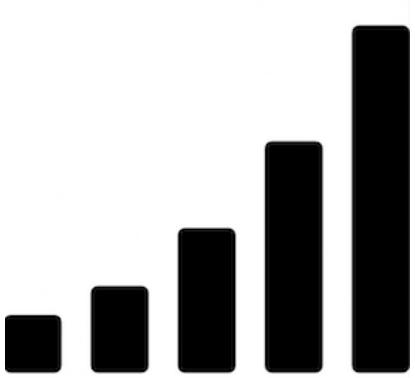

Figure 1: A typical depiction of a "signal" measurement

So we've defined our constituent components, signal and nose. The ratio between them is simply the signal divided by the nose. I think we can move to the next section now.

Maximizing Signal-to-Nose Ratio

But how do we maximize our signal-to-nose ratio? Mathematically it can be done by increasing the number of bars we get (the signal) or by decreasing the nose levels. This

is not a new idea. There is evidence of these kinds of efforts going back to the ancient Egyptians. When constructing the Sphinx, they attempted to maximize their signal-to-nose ratio by doing away with the nose altogether. This was an admirable effort, but the ancient Egyptians' lack of cell phones ultimately capped their signal-to-nose ratio at 0.

Figure 2: A failed attempt by the ancient Egyptians to maximize their signal-to-nose ratio

Despite the foibles of the ancient Egyptians, recent efforts to maximize the signal-to-nose ratio have proven quite promising. This excerpt from "Advancements of Medical Electronics: Proceedings of the First International Conference" shows that significant progress has been made:

"Enhancement in SNR—the ratio between related signal and nose is improved by decreasing other nuisance level and increasing stimulation related signal level" [9]

Unfortunately, the entire text of the proceedings costs $200 for a digital version, so our shared scientific understanding stops there.

Private companies have also made progress in attempting to maximize the signal to nose ratio. NXP's ultra-low power 8-bit 40 Msps universal ADC0801S040 is advertised as having "Best in class linearity and signal-to-nose ratio". At first glance, it seems like their claim is impossible:

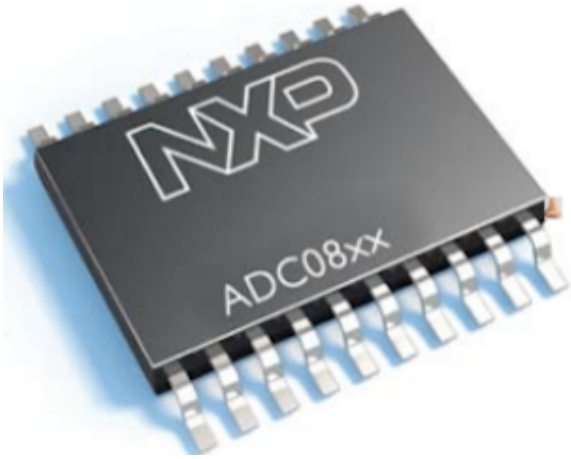

Figure 3: The NXP ADC0801S040

When one first looks at the chip, it seems to not have a nose at all, which would make its signal-to-nose ratio undefined regardless of how many bars it has! However, upon closer inspection we observe…

Figure 4: Close-up of NXP ADC0801S040

It does have a nose after all! The folks at NXP seem to have discovered a way to manufacture very tiny noses, drastically

increasing the signal-to-nose ratio of their chips.

Further Work

Because this is the first published work to examine the signal-to-nose ratio in depth, there is much more work to be done. Further research is needed in the affect of increasing signal vs. simply decreasing nose.

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