NeuroSky
Brain Wave Sensors for Every Body

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Reliability of Raw EEG data on Android

Martin Poulsen
May 29, 2013 @ 08:45 AM

Hi,

I am recording some raw EEG on an Android device using the MindWave Mobile. From a few experiments, It seems the number of samples output during one minutes of recording varies a bit, and I was wondering if there is a way to account/compensate for lost samples?

Is it best to assume the samplerate of 512Hz or induce samplerate by recordingtime / samples?

2 Posted by **David** on May 29, 2013 @ 02:51 PM   **SUPPORT STAFF** 💬

Hi Martin,

Thank you for using NeuroSky.

The MindWave Mobile will be trying to send the RAW samples at 512Hz.

6 *people watching.*

~~New Issue~~ ✓

Conversation Started

A conversation has been started with the NeuroSky - Home Page staff to resolve this discussion.

Close the discussion ⟳

Permissions 🔒

*This discussion is **private**. Only you and NeuroSky - Home Page support staff can see and reply to it.*

📶 **Comments Feed**

If you start an Android timer for 1 second and collect all the samples, you would expect 512. But in practice there are many thing to perturb this. Both the MindWave Mobile and your Android device have there own clocks/resonators that drive their timing. the chances that they are identical is almost 0. So sooner or later they will disagree on the length of a second.

I think the best approach is to avoid the problem by just collecting 512 RAW samples and calling that a second. That way you don't have to be concerned about the hardware clocking differences.

If you are finding that the sample rate is way off, loosing many samples per second, then there are probably other issues. It could be that there is radio frequency interference that is effecting the Bluetooth communications. Or it can be that the Android device is overloaded and can not keep up with the incoming RAW samples. Try running without the Android Debugger, it has to run on your target device and will be consuming some of your CPU resources.

I hope that helps.
-David

Ashley Schultz **closed** this discussion on Jun 03, 2013 @ 09:41 PM.

Martin Poulsen **re-opened** this discussion on Jun 11, 2013 @ 11:14 AM

3 Posted by **Martin Poulsen** on Jun 11, 2013 @ 11:14 AM

Hi David,

Thanks for the answer, I will assume 512 samples is 1 second - it is pretty close to the expected sample count.

I do have one question about the raw data I'm getting. I attached a plot of a raw eeg recording. All my recordings - as the attached example - have the same positive shift above zero (I would expect the mean value to be 0 but attached plot shows it is higher) and a few typical values (shows in attached plot as horizontal "lines"). Does all this look normal?

Thanks,

Martin

📎

[raw_eeg.pdf](raw_eeg.pdf)
495.4 KB

Hi Martin,
What you are seeing is called the DC offset or DC bias.
I suppose it is possible for it to appear negative. In part it is driven by the electrical characteristics of the hardware components. It is also effected by the person wearing the headset and the environmental conditions.

If you find it troublesome, you can remove the DC offset from the RAW samples as a 1st step in your signal processing. One easy approach I have seen people use:
- after you get a good signal indication, collect a few seconds of RAW samples, average them and then remove that value from each sample value going forward. (so, get a DC offset at the beginning of a session and use it for the remainder of the session) After the DC offset is removed, some would call it a DC balanced signal.
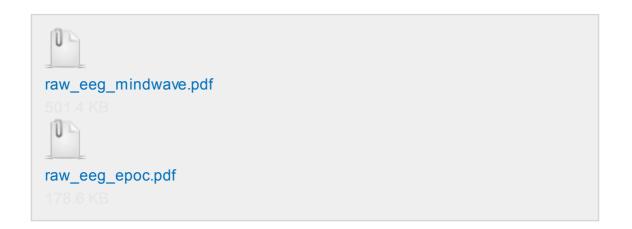
I hope that helps,

-David

Hi again David,

Thanks for explaining the DC offset, I now remove it as the first step in processing the signal.

I still think it is a bit strange that the raw data seems to "prefer" certain values: 80, -40, -170, -300 (plot attached in file raw_eeg_mindwave.pdf). I see this pattern across all recordings I make with the MindWave.

I don't find this pattern in raw EEG recorded with the Emotive EPOC (plot attached in file raw_eeg_epoc.pdf). Does my MindWave recording look sound?

raw_eeg_mindwave.pdf
501.4 KB

raw_eeg_epoc.pdf
178.6 KB

Hi Martin,
Do you know what AC frequency your local power uses?

It might be that you need to add a filter to remove the 50 cycle or 60 cycle hum from the local power grid.

MindWave Mobile is built for one or the other power systems. And have a filter built in to handle the local power at the ship to address.

If it is used in an area with different AC frequency, it wont be filtering it out.
And you will want to add your own filter step.

Let me know if the frequency mismatch is a possibility.

Regards,
-David

Hi Martin,
We looked at your plots. Maybe it isn't so bad. Can you replot trying to show the same number of samples? The MindWave Mobile plot is much more compressed.

Since you are familiar with other equipment, you might consider using some gel with the MindWave Mobile during you collection period. At least until we get this issue sorted out.

If you want, you could also send the RAW data as an Excel file (or similar) and we can look in closer detail.

Regards,
-David

Hi again David,

Thanks for taking the time to look at my recordings! I have attached a plot with similar density than the epoc plot, I still see these horizontal lines. I also attached the data as .csv and .mat (in a vector called "data").

Best,

Martin

[raw_eeg_mindwave_xlim_1-35000_.pdf](#)
184.7 KB

[mindwave_raw_eeg.csv](#)
2.1 MB

[mindwave_raw_eeg.mat](#)
2.2 MB

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9 Posted by **David** on Jul 01, 2013 @ 03:17 PM   SUPPORT STAFF 💬

Hi Martin,
Sorry for the delay. I haven't had time to look in detail.
It might be that those are eye blinks.

You might try to collect some data were you control the timing of your eye blinks.
If it does correspond to eye blinks, there is a simple technique for removing them.

(there are more sophisticated techniques)

The signals from eye blinks come from the muscles directly under the sensor. They may appear much stronger then those from within the skull. A simple way is to decide on some threshold, and any value beyond the threshold will be called an "eye blink". Just remove them by replacing the sample value with the preceding or following sample value.

Please let me know if it matches when you try to control your eye blinks.

Regards,
-David

10 Posted by **Martin Poulsen** on Jul 04, 2013 @ 05:52 AM

Hi David,

Again, thanks for taking the time to looking at the recordings!

I am not sure I understand how the horizontal lines could be eye-blinks since they mean that over the whole recording a lot of samples (even many per second which could not be explained by eye-blinks) take approximately one of the 3 frequent values (the three horizontal lines in the plot). Or am I misunderstanding you? Anyway, I have tried making recordings where I blink, move my eyes and clench my jaw in a pattern and the recordings look the same regarding the horizontal lines.

11 Posted by **Matt** on Jul 05, 2013 @ 12:22 PM   SUPPORT STAFF 💬

Hi Martin,

It looks like it's an issue with your parser. Most of the time the signal looks typical, but there are, at times, large point-to-point variances, which look like bad data.

Can you share your code?

Thanks,

Matt

Ashley Schultz **closed** this discussion on Jul 12, 2013 @ 05:15 PM.

Martin Poulsen **re-opened** this discussion on Jul 29, 2013 @ 05:30 AM

12 Posted by **Martin Poulsen** on Jul 29, 2013 @ 05:30 AM

Hi again,

Not much code is involved up till the point where I dump the raw data posted earlier - I have attached the relevant parts of the Android recording activity.

Thanks again!

MindWave_raw_data_recording.rtf

3 KB

13 Posted by **David** on Aug 08, 2013 @ 03:43 PM   SUPPORT STAFF

Hi Martin,

I am sorry for the long response time. I have been away.

I looked at the code you sent. I don't see any obvious problem to explain what you are seeing.

If you are running with the debugger, you might try turning it off.
We have seen that on some devices using the debugger significantly changes the timing of things. It is possible that you are seeing data loss caused when something else (the debugger) is taking so much cpu time that your code can't read the data before it is overwritten by new incoming data.

Regards,
-David

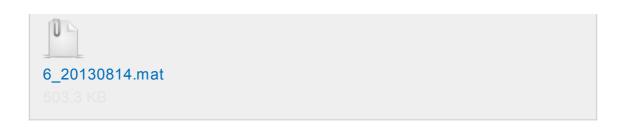14 Posted by **Martin Poulsen** on Aug 20, 2013 @ 04:11 AM

Hi David,

Thanks once again for your answer. I am not running with the debugger, I too have also experienced all sorts of issues running performance demanding applications while debugging with the android debugger.
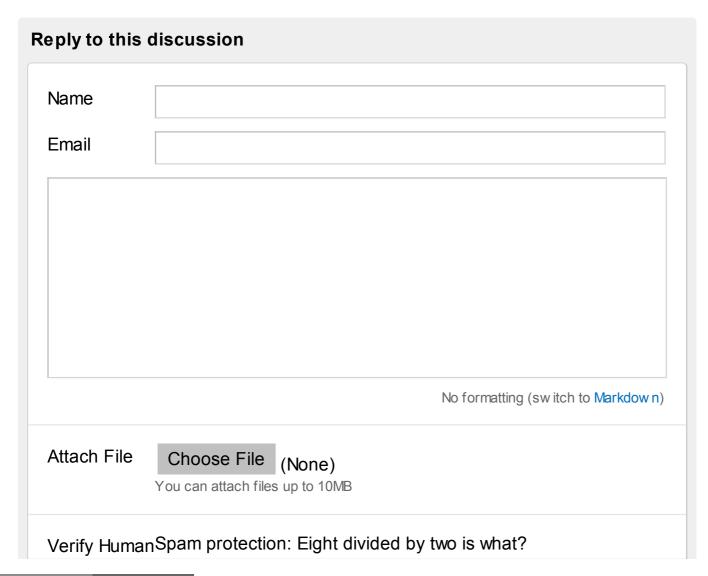
I have attached another recording, maybe you would check if you see the same large point-to-point variances? - and what exactly are the criteria for a too large variation? Maybe I should implement a filter in my application which discards data windows containing large point-to-point variances.
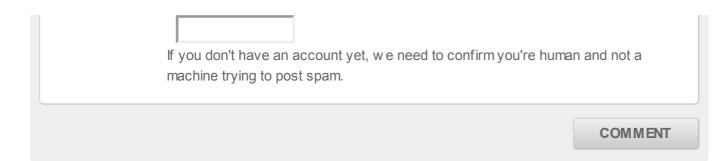
By the way I am building a real time neuro feedback application, any suggestions you might have in terms of filtering the raw data would be much appreciated.

Best,
Martin

[6_20130814.mat](#)

503.3 KB

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No formatting (switch to Markdown)

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Verify Human Spam protection: Eight divided by two is what?

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