EEG Data Codebook

0. General Info

0a. Cohort and patient meta-data

Data are derived from a cohort of patients resuscitated from sudden cardiac arrest at a single center. Cardiac arrest is the most common cause of death in high-income nations, including the United States, and reflects abrupt cessation of blood flow and effective cardiac contraction. It may result from more than one `etiology`, including heart attack, cardiac arrhythmia, trauma, respiratory failure or drug overdose. It commonly occurs out-of-hospital (`oohca`), but may also occur in-hospital. By convention, cardiac arrest occurring in the emergency department (`edarrest`) is considered an out-of-hospital arrest. A majority of patients at our center are transferred (`transfer`) from other hospitals. For this reason, initial details about their arrest are sometimes a bit fuzzy. Often, some prognostic features like their initial rhythm (`rhythm`) are known, but other details such as their total duration of cardiopulmonary resuscitation (`duration`), whether they received lay-person CPR after they collapsed (`bystander_cpr`) or whether their collapse was witnessed (`witnessed`) are less well defined. Some of these characteristics (e.g., `bystander_cpr` and `witnessed`) are only relevant to arrests occurring outside the hospital and emergency department. For the same reason, the exact time of the collapse (`arresttime`) may be missing, but we can usually ascertain the overall date of the arrest (`arrestdate`) Our database includes branching logic, so when values are irrelevant they are blank. When categorical variables are unknown, that category is selected. When continuous variables are unknown they take on a value of -1.

When patients arrive to the hospital, they typically have several initial prognostic assessments. An initial examination by a physician is summarized as a 4-level ordinal illness severity score (`ca_type`) (https://www.ncbi.nlm.nih.gov/pubmed/25636896). Type I patients are awake, rarely undergo EEG monitoring, and are typically excluded from by researchers interested in this data set. A CT scan of the brain is often performed as well. We extract certain features from this CT scan, most notably the ratio of grey matter to white matter density (`gwr`), which is strongly associated with outcome (>= 1.4 is normal, lower is worse).

Thereafter, patients are admitted to the intensive care unit, where electroencephalographic monitoring begins (`eeg`). Although it is started as soon as possible, in reality this occurs on average 8-12 hours after the initial collapse. Monitoring continues for hours to days, and is typically discontinued when either: 1) a patient awakens from coma; 2) a patient dies or shows convincing signs of irrecoverable injury; 3) one to two days pass with no useful information obtained from monitoring; or 4) another patient needs the monitoring device (they are a limited resource). Thus, duration of monitoring is not at random with respect to the clinical setting, but the reason to discontinue observation is not straight forward.

Major outcomes of interest in the data set are survival to hospital discharge (`surv`), awakening from coma while in the hospital (`follow_com`), and proximate cause of death (`death_cat`). The former two we have typically combined into a composite binary outcome of "awake and alive at hospital discharge" since patients can often be kept alive indefinitely with aggressive life support even if they have no chance to recover. The latter bears some special consideration. Patients may suffer severe multiple-system organ failure after cardiac arrest and die from events that may or may not be captured in measures of brain activity (e.g., an awake patient with intact brain may suffer a second cardiac arrest). They may also have care withdrawn for reasons that may or may not be related to brain injury (e.g., the elderly patient with a living will who never wanted care in the intensive care unit for any reason). They may progress to brain death (devastating brain injury, but typically easy to identify early on). Finally, they may have care withdrawn for perceived poor neurological prognosis. These patients invariably will die, but some might have recovered in the counterfactual where care had been continued. Thus, the ground truth value for `surv` is often never observed. In all cases but brain death, prognostic signals may correctly suggest recovery potential despite an observed death. Similarly, algorithms trained to predict prognosis in this cohort must account for these factors to avoid learning to be excessively pessimistic.

0b. Time series data

(Electroencephalography) EEG measures brain activity. Raw waveform data reflect the voltage difference between an electrode adhered to the patient's scalp and some reference (typically either an adjacent electrode or a common average of all the other electrodes). Electrodes are adhered in standard positions, according to the 10-20 International System of electrode placement (10–20 system (EEG)). At our hospital, data are typically recorded at 256Hz from 22 electrodes. The data currently stored in our database are features that have been extracted from these waveform data.

We used Persyst to perform signal processing using various mathematical algorithms. Persyst also has algorithms for artifact detection and rejection, and all features have been generated in two forms: with and without artifact rejection applied. These artifacts include both physiological artifacts (e.g., electromyographic (EMG) artifact from muscle activity and shivering) and non-physiological artifacts (e.g., 60Hz interference from ambient alternating current electrical devices). A total of `6037` columns containing data at a frequency of `1Hz` are generated from this signal processing (with a second set of `6037` generated with artifact rejection). Each column represents a feature; column names are identical for data generated with and without artifact rejection. We tag the data with `AR` and `NoAR` for these two method of generation of data, respectively. When data is exported from the database into CSV files, the default setting is to export the `AR` version. The user can choose between the two forms before exporting from the user interface. This codebook explains the clinical and mathematical meaning of each column. We expect that researchers in the field of data analytics and machine learning would find this document especially helpful in tasks such as feature extraction and correlation exploration.

The column names in the database is encoded into a form of `Ix_y`, where `I` is the prefix letter, followed by two integers `x` and `y` with an underscore between them. All the columns generally falls into one of the 13 categories introduced later. The `x` values, ranging from 1 to 270, encodes the measurement categories as the following table.

x	measurement
1	Artifact Intensity
2	Electrode Signal Quality
3	Seizure Probability
4 - 42	FFT (Fast Fourier Transformation) Spectrogram
43 - 81	aEEG
82 - 120	Peak Envelope, 0 - 25 Hz
121 - 159	Rhythmicity Spectrogram
160 - 171	Asymmetry EASI/REASI
172 - 176	Relative Asymmetry Spectrogram
177 - 191	Spikes
192 - 230	Suppression Ratio
231 - 269	aEEG+ (0.16 - 25Hz) (LFF 1 sec, HFF 25 Hz, custom (off))
270	Time

1. Artifact Intensity

- `x = 1`
- `y = [1, 3]`
- There are 3 columns in this category, each of which is a physiological artifact. Muscle (EMG) typically reflects shivering, and may be a clinically useful measure of illness severity. It does not reflect brain activity, however. Vertical and lateral eye movements are generated by the electrical potential of the retina as it moves in the head.

y	measure
1	Muscle
2	V-Eye
3	L-Eye

2. Electrode Signal Quality

- `x = 2`
- `y = [1, 24]`
- There are 24 columns in this category, each of which is the signal quality of the specific electrode. When the electrical contact between the electrode and the scalp is disrupted, the signal quality deteriorates and data from that electrode should be questioned. In the artifact-rejected time series, signals from low-quality electrodes are exported as N/A.

y	electrode	y	electrode	y	electrode
1	Fp1	9	A1	17	F4

y	electrode	y	electrode	y	electrode
2	F7	10	Fz	18	C4
3	T3	11	Cz	19	P4
4	T5	12	Fp2	20	A2
5	O1	13	F8	21	Pz
6	F3	14	T4	22	T1
7	C3	15	T6	23	T2
8	P3	16	O2	24	Ref

- The range of the values: `[0,1]`

3. Seizure Probability

- `x = 3`
- `y = 1`
- There is only one column in this category. Persyst uses an artificial neural network trained on annotated EEGs to estimate the probability of seizure at any given time from the entire EEG signal. NOTE, this algorithm was trained on EEGs obtained in epilepsy patients, a fundamentally different patient population. Thus, the sensitivity and specificity of this feature with regards to a clinical gold standard (expert interpretation) is believed to be poor in this dataset.

4. FFT (Fast Fourier Transformation) Spectrogram

- `x = [4, 42]`
- `y = [1, 40]`
- Different EEG frequencies have different meanings. For example, alpha frequencies (8-13Hz) are typical of awake patients. Beta frequencies (13-20Hz) are typically generated by healthy brain under the influence of sedative medications. Slower frequencies (delta (0-4Hz) and theta (4-8Hz) are generated by a brain with some injury or dysfunction). In addition to the instantaneous frequency, variability in the bandpass filtered spectral power may have meaning. For example, alpha variability (see, for example, https://www.ncbi.nlm.nih.gov/pubmed/12134937) is a favorable prognostic sign after acute brain injury.
- There are three different subcategories for FFT spectrogram values, encoded into the `x` values.
    - `I4_y` and `I5_y` are the mean values of all the electrodes in the left and right hemisphere, respectively.
    - `I6_y` to `I24_y` are the mean value voltage difference of a single electrode against all other 17 electrodes (common reference average).
    - `I25_y` to `I42_y` are the voltage difference of two adjacent electrodes (longitudinal bipolar montage).

x	electrode	x	electrode	x	electrode
4	Left Hemisphere	6	Cz-Av17	25	CZ-PZ
5	Right Hemisphere	7	Pz-Av17	26	Fz-Cz
			6	Cz-Av17	25

x	electrode	x	electrode	x	electrode
			7	Pz-Av17	26
			8	Fz-Av17	27
			9	P4-Av17	28
			10	C4-Av17	29
			11	F4-Av17	30
			12	P3-Av17	31
			13	C3-Av17	32
			14	F3-Av17	33
			15	O2-Av17	34
			16	T6-Av17	35
			17	T4-Av17	36
			18	F8-Av17	37
			19	Fp2-Av17	38
			20	O1-Av17	39
			21	T5-Av17	40
			22	T3-Av17	41
			23	F7-Av17	42
			24	Fp1-Av17	

- The `y` values encode the different frequency range of the FFT spectrogram. The frequency ranges from `0Hz` to `0.5Hz` on `y = 1`, increasing in a step of `0.5Hz` for each increment of `y` from 0Hz to 20Hz.

y	freq.	y	freq.	y	freq.	y	freq.
1	0 - 0.5 Hz	11	5 - 5.5 Hz	21	10 - 10.5 Hz	31	15 - 15.5 Hz

y	freq.	y	freq.	y	freq.	y	freq.
2	0.5 - 1 Hz	12	5.5 - 6 Hz	22	10.5 - 11 Hz	32	15.5 - 16 Hz
3	1 - 1.5 Hz	13	6 - 6.5 Hz	23	11 - 11.5 Hz	33	16 - 16.5 Hz
4	1.5 - 2 Hz	14	6.5 - 7 Hz	24	11.5 - 12 Hz	34	16.5 - 17 Hz
5	2 - 2.5 Hz	15	7 - 7.5 Hz	25	12 - 12.5 Hz	35	17 - 17.5 Hz
6	2.5 - 3 Hz	16	7.5 - 8 Hz	26	12.5 - 13 Hz	36	17.5 - 18 Hz
7	3 - 3.5 Hz	17	8 - 8.5 Hz	27	13 - 13.5 Hz	37	18 - 18.5 Hz
8	3.5 - 4 Hz	18	8.5 - 9 Hz	28	13.5 - 14 Hz	38	18.5 - 19 Hz
9	4 - 4.5 Hz	19	9 - 9.5 Hz	29	14 - 14.5 Hz	39	19 - 19.5 Hz
10	4.5 - 5 Hz	20	9.5 - 10 Hz	30	14.5 - 15 Hz	40	19.5 - 20 Hz

5. aEEG

- `x = [43, 81]`
- `y = [1, 5]`
- Amplitude-integrated EEG (aEEG) is one way of describing the overall EEG amplitude. Very low amplitude EEGs are a sign of injury or dysfunction. Similarly, extremely high amplitude EEGs may also be abnormal (for example, representing seizure activity). Importantly, more complex patterns within this feature may also be highly useful. For example, a pattern of alternating flat EEG and abrupt bursts of extremely high amplitude activity is a sign of particularly severe brain injury (burst suppression with identical bursts, see, for example https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4982787/) compared to alternating flat and lower (normal) amplitude activity that is common and reversible (burst suppression).
- For historical reasons, aEEG filters out slow activity (< 1Hz) because this is uncommon in healthy brains. In cardiac arrest, frequencies from 0-1Hz are more common and may have greater clinical meaning, making the aEEG estimate of amplitude potentially troublesome. Other amplitude measures may be more useful (see below: peak envelope; aEEG+)
- There are three different subcategories for aEEG values, encoded into the `x` values.
  - `I43_y` and `I44_y` are the mean values of all the electrodes in the left and right hemisphere, respectively.
  - `I45_y` to `I63_y` are the mean value voltage difference of a single electrode against all other 17 electrodes.
  - `I64_y` to `I81_y` are the voltage difference of two adjacent electrodes.

x	electrode	x	electrode	x	electrode
43	Left Hemisphere	45	Cz-Av17	64	CZ-PZ
44	Right Hemisphere	46	Pz-Av17	65	Fz-Cz
			47	Fz-Av17	66

x	electrode	x	electrode	x	electrode
			48	P4-Av17	67
			49	C4-Av17	68
			50	F4-Av17	69
			51	P3-Av17	70
			52	C3-Av17	71
			53	F3-Av17	72
			54	O2-Av17	73
			55	T6-Av17	74
			56	T4-Av17	75
			57	F8-Av17	76
			58	Fp2-Av17	77
			59	O1-Av17	78
			60	T5-Av17	79
			61	T3-Av17	80
			62	F7-Av17	81
			63	Fp1-Av17	

- The `y` values encode the different methods used in downsampling the 256Hz data into 1Hz aEEG values.

y	method	
1	Max	
2	Min	
3	Median	
4	75 Percentile	
5	25 Percentile	

6. Peak Envelope, 0 - 25 Hz

- `x = [82, 120]`
- `y = 1`
- This is another peak-to-peak based measure of EEG amplitude, calculated differently than aEEG but summarizing the same general feature. Note the frequency range (0-25Hz), which is more inclusive of both faster and slower frequencies than aEEG.
- There are three different subcategories for peak envelope power values in the range of 0 - 25Hz, encoded into the `x` values.

- `I82_y` and `I83_y` are the mean values of all the electrodes in the left and right hemisphere, respectively.
- `I84_y` to `I102_y` are the mean value voltage difference of a single electrode against all other 17 electrodes.
- `I103_y` to `I120_y` are the voltage difference of two adjacent electrodes.

x	electrode	x	electrode	x	electrode
82	Left Hemisphere	84	Cz-Av17	103	CZ-PZ
83	Right Hemisphere	85	Pz-Av17	104	Fz-Cz
			86	Fz-Av17	105
			87	P4-Av17	106
			88	C4-Av17	107
			89	F4-Av17	108
			90	P3-Av17	109
			91	C3-Av17	110
			92	F3-Av17	111
			93	O2-Av17	112
			94	T6-Av17	113
			95	T4-Av17	114
			96	F8-Av17	115
			97	Fp2-Av17	116
			98	O1-Av17	117
			99	T5-Av17	118
			100	T3-Av17	119
			101	F7-Av17	120
			102	Fp1-Av17	

- There is only one `y` in each group, representing the peak envelope power of the selected electrodes.

7. Rhythmicity Spectrogram

- `x = [121, 159]`
- `y = [1, 97]`
- Rhythmicity develops for complex reasons in the brain, but generally speaking very rhythmic activity is a sign of brain dysfunction or injury.
- There are three different subcategories for rhythmicity spectrogram values, encoded into the `x` values.

- `I121_y` and `I122_y` are the mean values of all the electrodes in the left and right hemisphere, respectively.
- `I123_y` to `I141_y` are the mean value voltage difference of a single electrode against all other 17 electrodes.
- `I142_y` to `I159_y` are the voltage difference of two adjacent electrodes.

x	electrode	x	electrode	x	electrode
121	Left Hemisphere	123	Cz-Av17	142	CZ-PZ
122	Right Hemisphere	124	Pz-Av17	143	Fz-Cz
			125	Fz-Av17	144
			126	P4-Av17	145
			127	C4-Av17	146
			128	F4-Av17	147
			129	P3-Av17	148
			130	C3-Av17	149
			131	F3-Av17	150
			132	O2-Av17	151
			133	T6-Av17	152
			134	T4-Av17	153
			135	F8-Av17	154
			136	Fp2-Av17	155
			137	O1-Av17	156
			138	T5-Av17	157
			139	T3-Av17	158
			140	F7-Av17	159
			141	Fp1-Av17	

- The `y` values encode the different frequency range of the rhythmicity spectrogram. The frequency range of 0 - 20Hz were separated into 97 intervals. Bin length is defined according to a square root scale such that bin length is uneven in a linear scale. This is done because rhythmicity is typically more common in slower frequencies.

y	freq.	y	freq.	y	freq.	y	freq.
1	0 - 0.002 Hz	26	1.329 - 1.437 Hz	51	5.314 - 5.529 Hz	76	11.957 - 12.278 Hz

y	freq.	y	freq.	y	freq.	y	freq.
2	0.002 - 0.009 Hz	27	1.437 - 1.55 Hz	52	5.529 - 5.748 Hz	77	12.278 - 12.603 Hz
3	0.009 - 0.019 Hz	28	1.55 - 1.666 Hz	53	5.748 - 5.971 Hz	78	12.603 - 12.932 Hz
4	0.019 - 0.034 Hz	29	1.666 - 1.788 Hz	54	5.971 - 6.198 Hz	79	12.932 - 13.266 Hz
5	0.034 - 0.053 Hz	30	1.788 - 1.913 Hz	55	6.198 - 6.43 Hz	80	13.266 - 13.604 Hz
6	0.053 - 0.077 Hz	31	1.913 - 2.043 Hz	56	6.43 - 6.666 Hz	81	13.604 - 13.946 Hz
7	0.077 - 0.104 Hz	32	2.043 - 2.177 Hz	57	6.666 - 6.906 Hz	82	13.946 - 14.293 Hz
8	0.104 - 0.136 Hz	33	2.177 - 2.315 Hz	58	6.906 - 7.151 Hz	83	14.293 - 14.643 Hz
9	0.136 - 0.172 Hz	34	2.315 - 2.457 Hz	59	7.151 - 7.399 Hz	84	14.643 - 14.998 Hz
10	0.172 - 0.213 Hz	35	2.457 - 2.604 Hz	60	7.399 - 7.652 Hz	85	14.998 - 15.358 Hz
11	0.213 - 0.257 Hz	36	2.604 - 2.755 Hz	61	7.652 - 7.909 Hz	86	15.358 - 15.721 Hz
12	0.257 - 0.306 Hz	37	2.755 - 2.91 Hz	62	7.909 - 8.171 Hz	87	15.721 - 16.089 Hz
13	0.306 - 0.359 Hz	38	2.91 - 3.069 Hz	63	8.171 - 8.437 Hz	88	16.089 - 16.461 Hz
14	0.359 - 0.417 Hz	39	3.069 - 3.233 Hz	64	8.437 - 8.707 Hz	89	16.461 - 16.837 Hz
15	0.417 - 0.478 Hz	40	3.233 - 3.401 Hz	65	8.707 - 8.981 Hz	90	16.837 - 17.218 Hz
16	0.478 - 0.544 Hz	41	3.401 - 3.573 Hz	66	8.981 - 9.259 Hz	91	17.218 - 17.602 Hz
17	0.544 - 0.614 Hz	42	3.573 - 3.75 Hz	67	9.259 - 9.542 Hz	92	17.602 - 17.991 Hz
18	0.614 - 0.689 Hz	43	3.75 - 3.93 Hz	68	9.542 - 9.829 Hz	93	17.991 - 18.385 Hz
19	0.689 - 0.767 Hz	44	3.93 - 4.115 Hz	69	9.829 - 10.12 Hz	94	18.385 - 18.782 Hz
20	0.767 - 0.85 Hz	45	4.115 - 4.304 Hz	70	10.12 - 10.416 Hz	95	18.782 - 19.184 Hz

y	freq.	y	freq.	y	freq.	y	freq.
21	0.85 - 0.937 Hz	46	4.304 - 4.498 Hz	71	10.416 - 10.715 Hz	96	19.184 - 19.59 Hz
22	0.937 - 1.029 Hz	47	4.498 - 4.696 Hz	72	10.715 - 11.019 Hz	97	19.59 - 20 Hz
23	1.029 - 1.124 Hz	48	4.696 - 4.897 Hz	73	11.019 - 11.327 Hz		
24	1.124 - 1.224 Hz	49	4.897 - 5.104 Hz	74	11.327 - 11.64 Hz		
25	1.224 - 1.329 Hz	50	5.104 - 5.314 Hz	75	11.64 - 11.957 Hz		

8. Asymmetry EASI/REASI

- `x = [160, 171]`
- `y = 1`
- Absolute and relative asymmetry indices summarize a composite of regional variations in EEG signal compared to the rest of the brain. Some asymmetry is normal (for example, a healthy brain will have a more prominent EEG posteriorly (a "posterior dominant rhythm") in the 6-14Hz range) Other changes in asymmetry index may reflect brain injury (for example, loss of the posterior dominant rhythm).
- The `x` values encode multiple information pieces, including the index type, frequency interval and the location of the brain.

x	index type	freq.	location

x	index type	freq.	location
160	Absolute Index (EASI)	1 - 18 Hz	Hemi
161	Relative Index (REASI)	1 - 5 Hz	Hemi
162	Relative Index (REASI)	1 - 5 Hz	Parasagittal
163	Relative Index (REASI)	1 - 5 Hz	Posterior
164	Relative Index (REASI)	1 - 5 Hz	Temporal
165	Relative Index (REASI)	6 - 14 Hz	Hemi
166	Relative Index (REASI)	6 - 14 Hz	Parasagittal
167	Relative Index (REASI)	6 - 14 Hz	Parasagittal
168	Relative Index (REASI)	6 - 14 Hz	Posterior
169	Relative Index (REASI)01	1 - 18 Hz	Hemi
170	Relative Index (REASI)01	1 - 5 Hz	Hemi
171	Relative Index (REASI)01	6 - 14 Hz	Hemi

- There is only one `y` in each group, representing the value of specific measurement.

9. Relative Asymmetry Spectrogram

- `x = [172, 176]`
- `y = [1, 34]`
- The `x` values encode the location of the brain.

x	location
172	Anterior
173	Hemi
174	Parasagittal
175	Posterior
176	Temporal

- The `y` values encode the different frequency range of the relative asymmetry spectrogram. The frequency ranges from `1Hz` to `1.5Hz` on `y = 1`, increasing in a step of `0.5Hz` for each increment of `y`.

y	freq.	y	freq.	y	freq.	y	freq.
1	1 - 1.5 Hz	11	6 - 6.5 Hz	21	11 - 11.5 Hz	31	16 - 16.5 Hz

y	freq.	y	freq.	y	freq.	y	freq.
2	1.5 - 2 Hz	12	6.5 - 7 Hz	22	11.5 - 12 Hz	32	16.5 - 17 Hz
3	2 - 2.5 Hz	13	7 - 7.5 Hz	23	12 - 12.5 Hz	33	17 - 17.5 Hz
4	2.5 - 3 Hz	14	7.5 - 8 Hz	24	12.5 - 13 Hz	34	17.5 - 18 Hz
5	3 - 3.5 Hz	15	8 - 8.5 Hz	25	13 - 13.5 Hz		
6	3.5 - 4 Hz	16	8.5 - 9 Hz	26	13.5 - 14 Hz		
7	4 - 4.5 Hz	17	9 - 9.5 Hz	27	14 - 14.5 Hz		
8	4.5 - 5 Hz	18	9.5 - 10 Hz	28	14.5 - 15 Hz		
9	5 - 5.5 Hz	19	10 - 10.5 Hz	29	15 - 15.5 Hz		
10	5.5 - 6 Hz	20	10.5 - 11 Hz	30	15.5 - 16 Hz		

10. Spikes

- `x = [177, 191]`
- `y = 1`
- Epileptiform discharges ("spikes") are a sign of irritated brain. These discharges may be generalized or focal. Higher frequencies and more diffuse spikes are a sign of more severe brain injury.
- Each of the `x` encodes a measurement method for the spike values.

x	measurement
177	Spike Detections generalized (count per 10s)
178	Spike Detections generalized (count per sec)
179	Spike Detections left hemisphere (count per 10 sec)
180	Spike Detections left hemisphere (count per sec)
181	Spike Detections right hemisphere (count per 10 sec)
182	Spike Detections right hemisphere (count per sec)
183	Spike Detections vertex (count per sec)
184	Spike Detections, all foci (count per sec)
185	Spike Rate Threshold, right hemisphere >=3 per 10 sec, Spike Detections right hemisphere (count per 10 sec)
186	Spike Rate Threshold, generalized >=3 per 10 sec, Spike Detections generalized (count per sec)
187	Spike Rate Threshold, left hemisphere >=3 per 10 sec, Spike Detections left hemisphere (count per 10 sec)
188	Spikes >=3 per ten seconds (blue=left, red=right, yellow=L&R)
189	Spikes >=3 per ten seconds (blue=left, red=right, yellow=L&R)
190	Spikes >=3 per ten seconds (blue=left, red=right, yellow=L&R), green=generalized)
191	Spikes >=3 per ten seconds (blue=left, red=right, yellow=L&R), green=generalized)

- There is only one `y` in each group, representing the spike value of the selected measurement.

11. Suppression Ratio

- `x = [192, 230]`
- `y = 1`
- Suppression ratio is calculated as a 10 second summary, and reflects the proportion of that window that falls below a threshold voltage value of 2uV (suppression) compared to that which falls above the threshold. More suppressed EEG is a sign of more severe dysfunction or injury. Many EEGs are initially quite suppressed, and failure to recover is a particularly ominous sign (https://www.ncbi.nlm.nih.gov/pubmed/27033709).
- There are three different subcategories for suppression ratio values, encoded into the `x` values.
    - `I192_y` and `I193_y` are the mean values of all the electrodes in the left and right hemisphere, respectively.
    - `I194_y` to `I212_y` are the mean value voltage difference of a single electrode against all other 17 electrodes.
    - `I213_y` to `I230_y` are the voltage difference of two adjacent electrodes.

x	electrode	x	electrode	x	electrode
192	Left Hemisphere	194	Cz-Av17	213	CZ-PZ
193	Right Hemisphere	195	Pz-Av17	214	Fz-Cz
			196	Fz-Av17	215
			197	P4-Av17	216
			198	C4-Av17	217
			199	F4-Av17	218
			200	P3-Av17	219
			201	C3-Av17	220
			202	F3-Av17	221
			203	O2-Av17	222
			204	T6-Av17	223
			205	T4-Av17	224
			206	F8-Av17	225
			207	Fp2-Av17	226
			208	O1-Av17	227
			209	T5-Av17	228
			210	T3-Av17	229
			211	F7-Av17	230
			212	Fp1-Av17	

- There is only one `y` in each group, representing the suppression ratio of the selected electrodes.

12. aEEG+ (0.16 - 25Hz) (LFF 1 sec, HFF 25 Hz, custom (off))

- `x = [231, 269]`
- `y = [1, 5]`
- As above (aEEG) but with a broader frequency range to capture lower frequency activity (0.16 - 1Hz)
- There are three different subcategories for aEEG+ values, encoded into the `x` values.
  - `I231_y` and `I232_y` are the mean values of all the electrodes in the left and right hemisphere, respectively.
  - `I233_y` to `I251_y` are the mean value voltage difference of a single electrode against all other 17 electrodes.
  - `I252_y` to `I269_y` are the voltage difference of two adjacent electrodes.

x	electrode	x	electrode	x	electrode

x	electrode	x	electrode	x	electrode
231	Left Hemisphere	233	Cz-Av17	252	CZ-PZ
232	Right Hemisphere	234	Pz-Av17	253	Fz-Cz
			235	Fz-Av17	254
			236	P4-Av17	255
			237	C4-Av17	256
			238	F4-Av17	257
			239	P3-Av17	258
			240	C3-Av17	259
			241	F3-Av17	260
			242	O2-Av17	261
			243	T6-Av17	262
			244	T4-Av17	263
			245	F8-Av17	264
			246	Fp2-Av17	265
			247	O1-Av17	266
			248	T5-Av17	267
			249	T3-Av17	268
			250	F7-Av17	269
			251	Fp1-Av17	

- The `y` values encode the different methods used in downsampling the 256Hz data into 1Hz aEEG values.

y	method	
1	Max	
2	Min	
3	Median	
4	75 Percentile	
5	25 Percentile	

13. Time

- `x = 270`
- `y = 1`
- No clear meaning. All values are 0 for this column. Should always be discarded in any analytical tasks.