

1 Working with EEG data

Electroencephalograms (EEGs) are recordings of the electric potential on cranium skin. Research on brain activity uses EEGs to determine specific activity patterns in the brain. For example, epileptic seizures have a distinctive EEG signature. Certain emotive (fear, happiness) or cognitive (concentration, distraction) states, also show characteristic EEG signatures. Identification of such states of the brain from EEGs leads to a number of linear algebra problems. A typical EEG recording is within the lessons directory. It can be loaded into Octave, and the data can be plotted.

```
octave> load /home/student/courses/MATH547/lessons/eeg/eeg;
octave> data=EEG.data'; [m n]=size(data); disp([m n]);
      30504      32
octave> pdata=data./max(data)+meshgrid(0:n-1,0:m-1);
octave> hold on;
      for j=1:n
          plot(pdata(:,j));
      end;
      hold off;
octave> cd /home/student/courses/MATH547/homework; print -mono -deps eeg.eps;

octave>
```

There are $n = 32$ electrode recordings at $m = 30504$ moments of time, and plot produced by the above instructions is in Fig. 1 (The plot was displayed into a window, and the Screenshot utility was used to capture the image).

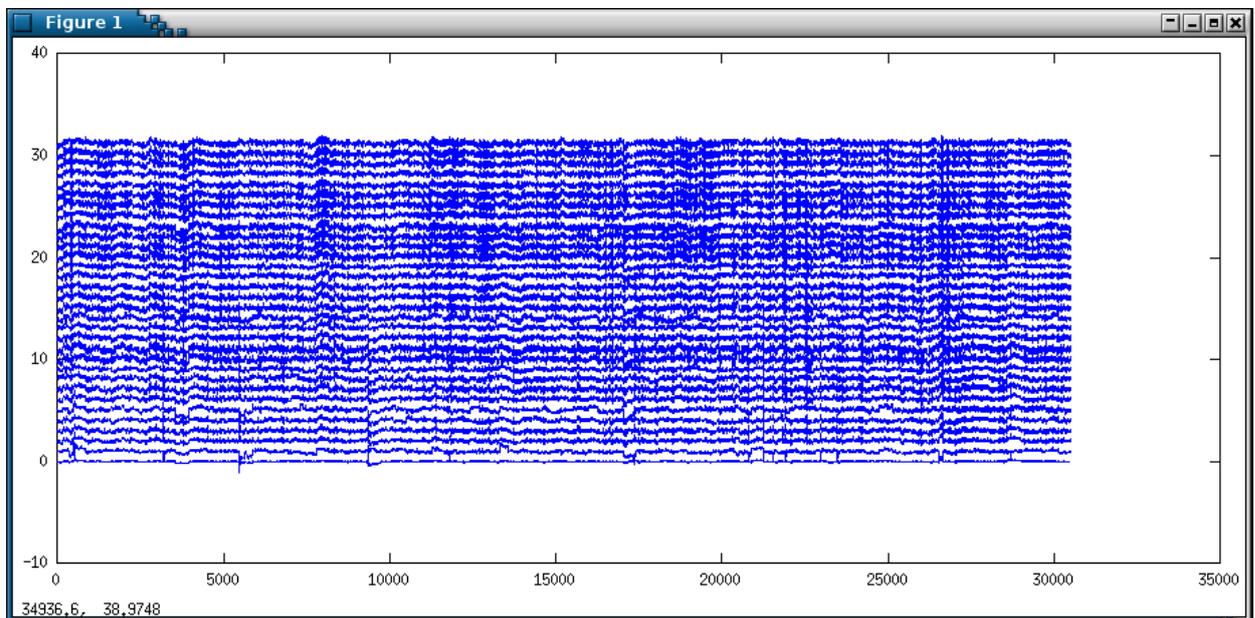


Figure 1. EEG recordings

A smaller time window of the recordings is shown in Fig. 2.

```
octave> hold on;
      for j=1:n
          plot(pdata(1001:1512,j));
      end;
      hold off;
```

```
octave> cd /home/student/courses/MATH547/homework; print -mono -deps eegwin.eps;
octave>
```

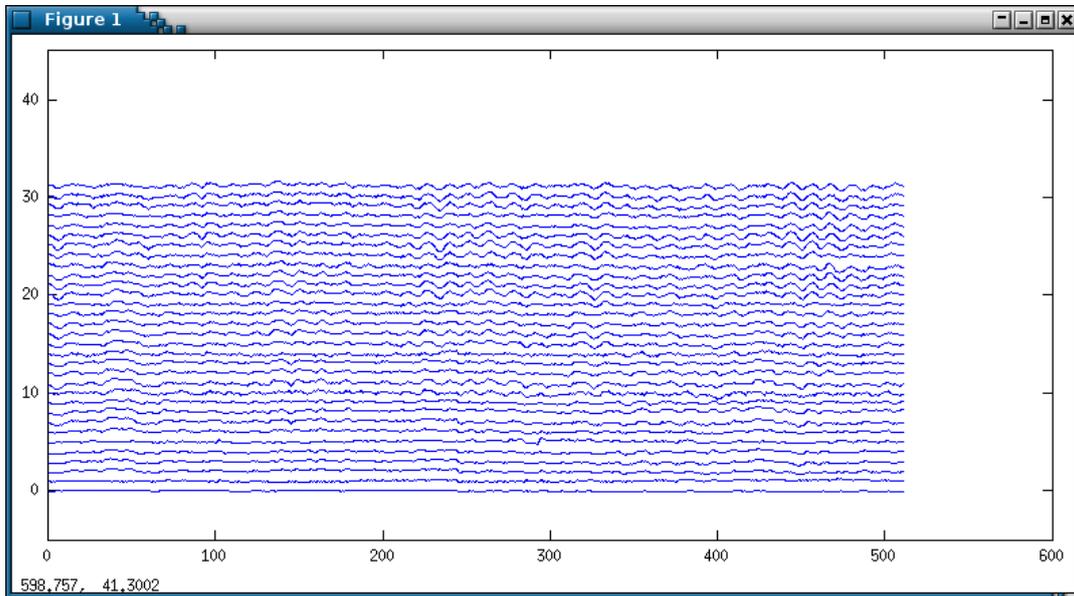


Figure 2. EEG recording from time index $i = 1001$ to $i = 1512$