

Announcements

- Open [https://datahub.ucsd.edu/hub/user-redirect/git-pull?
repo=https%3A%2F%2Fgithub.com%2Fgquer%2Fdsc-96_winter19](https://datahub.ucsd.edu/hub/user-redirect/git-pull?repo=https%3A%2F%2Fgithub.com%2Fgquer%2Fdsc-96_winter19)
- **Readings:** 07_audio/readings.md **due on Friday 2/22 at 6PM**

Audio is Data!

DSC 96
Thanks to Colin Jemmott

Image is data

Data We have three values per pixel (RGB)

Pixel [0,0]

R = 174

G = 198

B = 234



Image is data

Data We have three values per pixel (RGB)

Pixel [0,0]

R = 174

G = 198

B = 234



Image is data

Data We have three values per pixel (RGB)

Pixel [0,0]

R = 174

G = 198

B = 234



Image is data

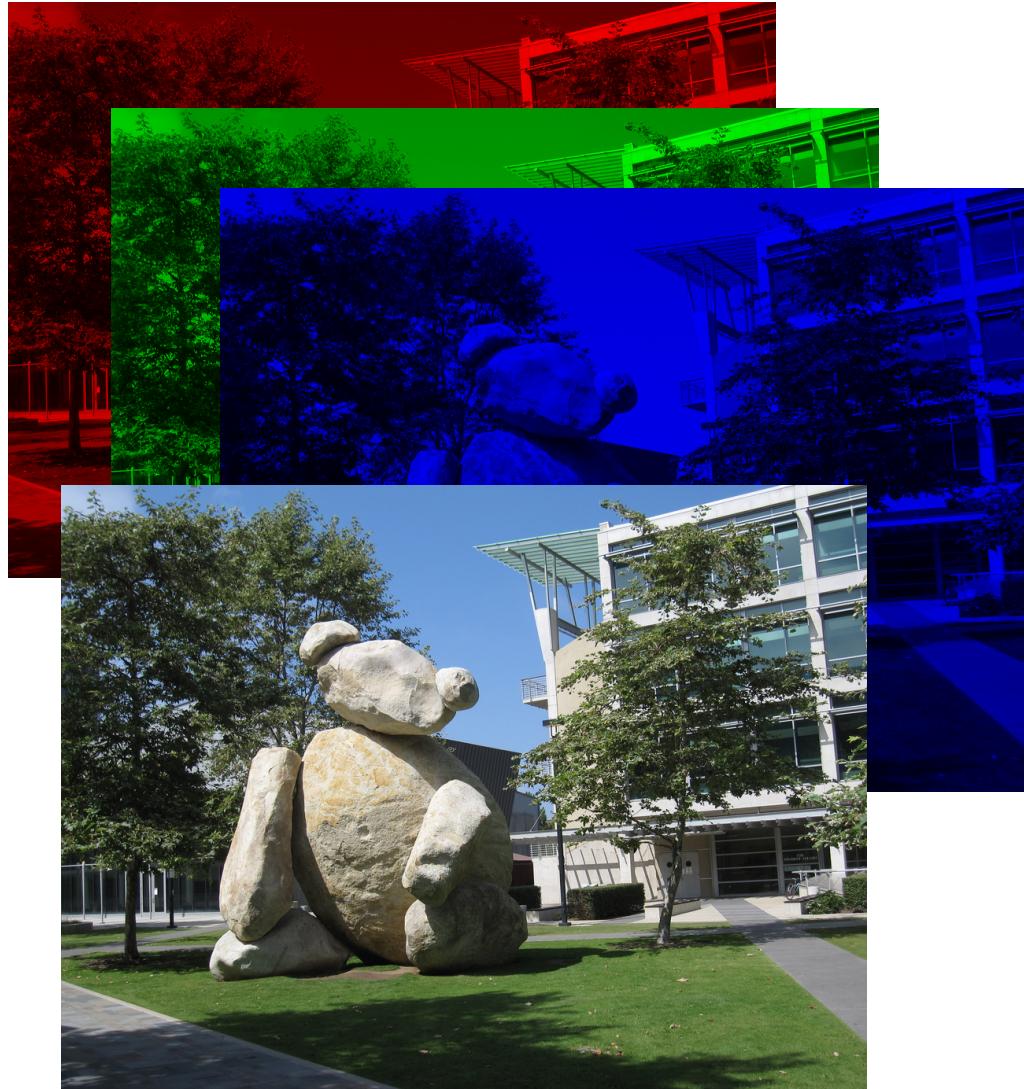
Data We have three values per pixel (RGB)

Pixel [0,0]

R = 174

G = 198

B = 234



Data and Information



Data and Information

Data This is a 700x629 RGB image (700x629x3 = 1,320,900 points!)

Pixel RGB = 236, 34, 50

Information

what information is really inside that image?



Data and Information

Data This is a 700x629 RGB image (700x629x3 = 1,320,900 points!)

Pixel RGB = 236, 34, 50

Information

what information is really inside that image?

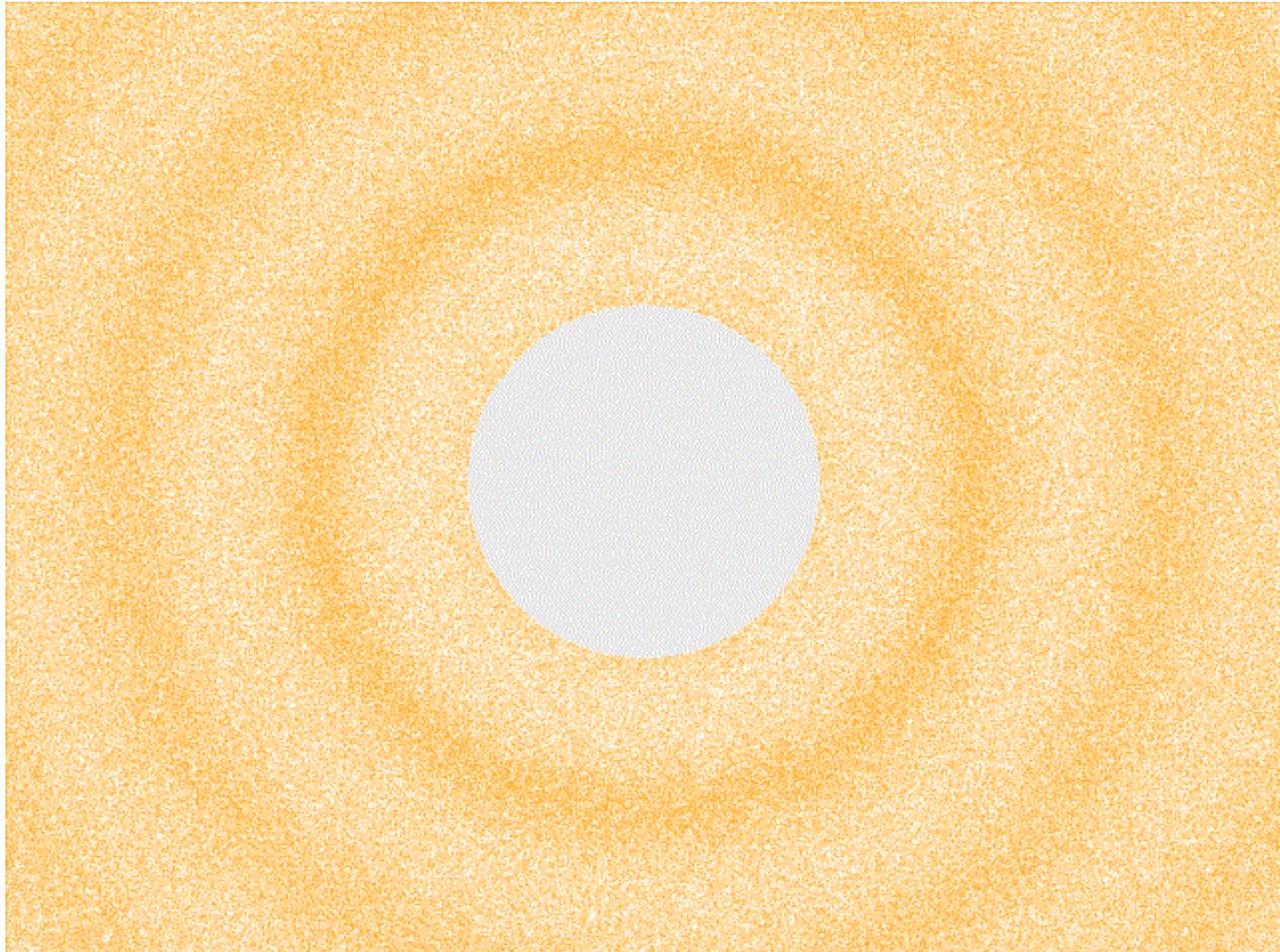


Image .jpg
700x629 pixels
all pixels = 236, 34, 50

Sound

Sound is a vibration that propagates as an audible longitudinal wave of pressure, through a transmission medium such as a gas, liquid or solid.

How hard you shake it is related to loudness and how fast you shake it is related to frequency.

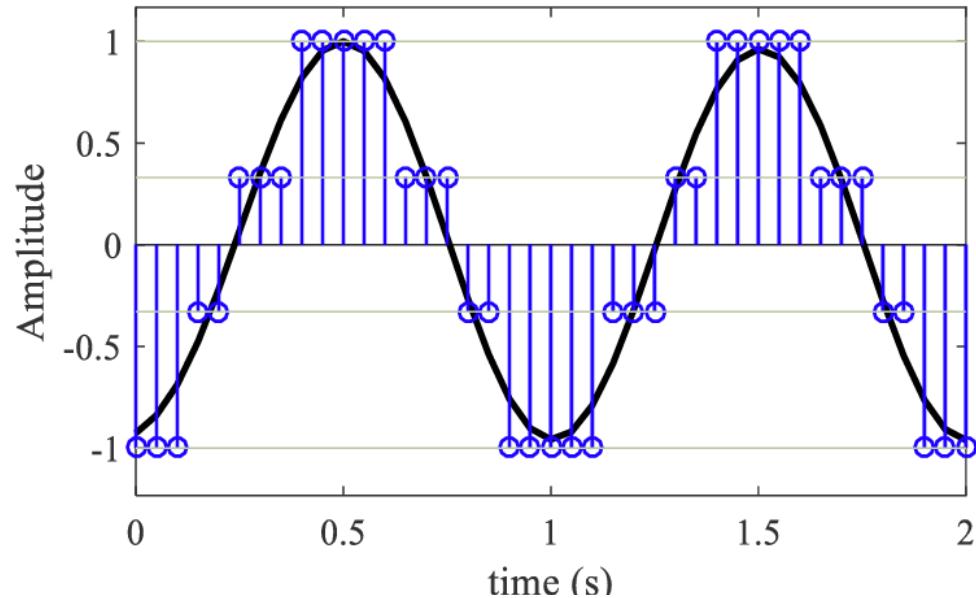
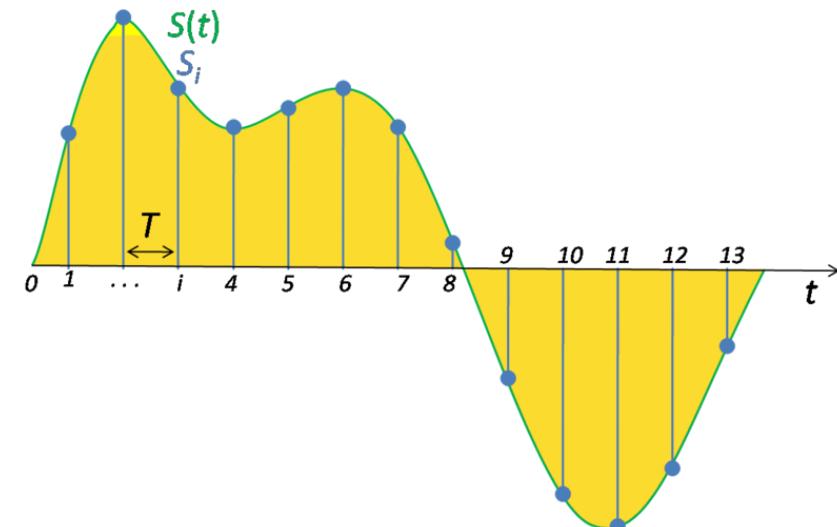


Time-based Sampling

Sound is continuous in time
and amplitude (“analog”)

Recording is transducing and
storing sound waves.

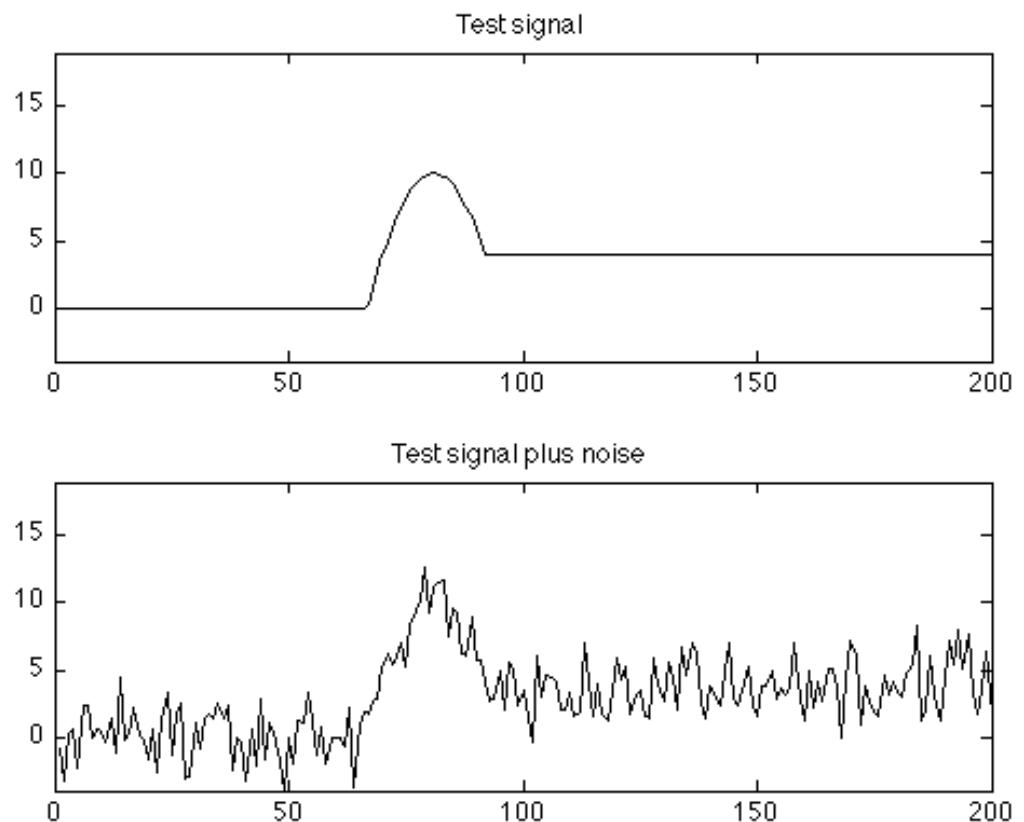
Nyquist-Shannon sampling
theorem: sample at more than
twice the bandwidth and you
can make a perfect
reconstruction.



Noise

Audio is linear, in the sense that when two signals combine they just add.

Noise is unwanted sound, and is often measured as a power ratio called Signal to Noise Ratio (SNR)



Time and Frequency

Frequency is measured in Hertz, units 1/s

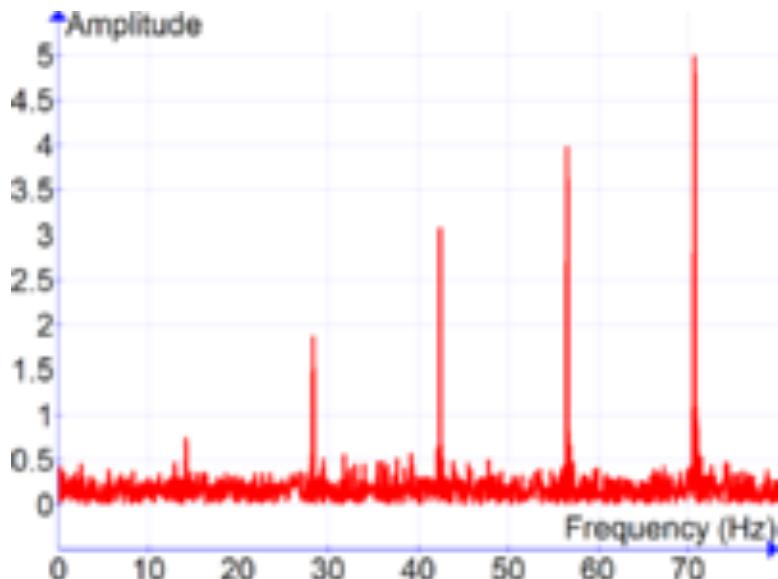
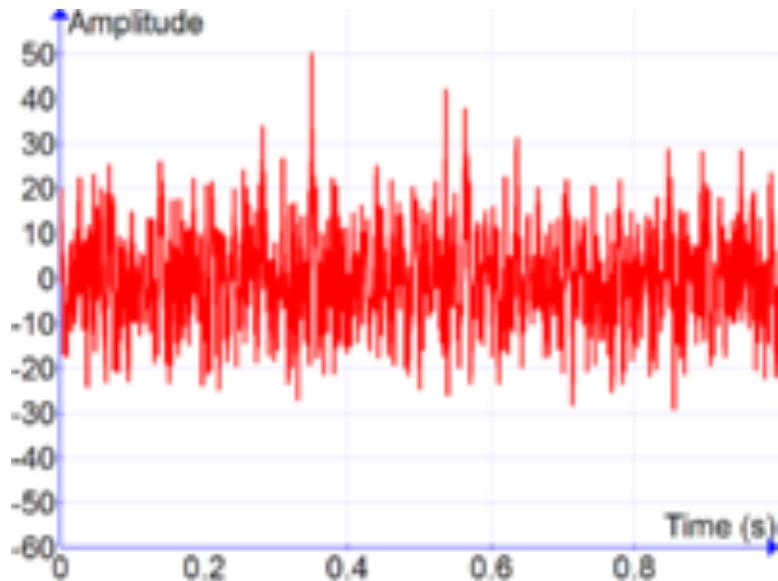
Humans generally hear from 20 Hz to 20 kHz

Frequency is generally perceived as pitch.

Amplitude and pitch are independent.

Tones have distinct frequencies, while noise and impulses have broad frequencies.

Average male voice is 120 Hz, average female voice is 210 Hz. Middle A on a piano is 440 Hz.



Formats

Examples: WAV, FLAC, mp3, AAC, ...

Differences:

- Compression (lossy versus lossless)
- Streamable
- Decode vs encode difficulty
- Proprietary

Today's Exercise

Making sounds from scratch!

Using Python you will make:

- A simple tone
- An amplitude modulated tone
- Noise
- A short song!