ECG Simulator Based on a Neural Network Trained With Real Patient Data

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Data

- Created Dataset
  - Ex: normal sinus rhythm, bradycardia, tachycardia, Vfib ...
  - Images with all six leads
  - P waves, QRS wave, and T waves
Data

- Ecg data from anonymous patients found online
- Google Scholar
  - Using google scholar for research and find ideas on how to solve our problem
Tools

- Python with Jupyter Notebook or Visual Studio Code
- Github
- Numpy library for math calculations
  - `np.cos` (cosine wave), `np.quad` (integrate), etc.
Tools

- Desmos graph/NumPy
  - Using desmos graph and/or Matplotlib to test our functions that represent the waves.

\[
\begin{align*}
  f(x) &= -2.5 \cdot \frac{x}{4} + 2.5 \left\{ 0 < x < \frac{4}{2} \right\} \\
  f(x) &= 2.5 \cdot \frac{x}{4} + 2.5 \left\{ -\frac{4}{2} < x < 0 \right\} \\
  f(x) &= \left( -2 \cdot 1 \cdot \frac{(x + 25)}{4} + 1 \right) \cdot 475 \cdot \left\{ -1 < x < 0 \right\} \\
  f(x) &= \left( 2 \cdot 1 \cdot \frac{(x - 25)}{4} + 1 \right) \cdot 125 \cdot \left\{ -6 < x < -1 \right\}
\end{align*}
\]
Other Tools

- **Math**
  - Basic Understanding of calculus concepts like integrating
  - Other

\[
f(x) = \begin{cases} 
\left( \frac{-bax}{l} + a \right) & \text{if } (0 < x < \frac{l}{b}) \\
\left( \frac{bax}{l} + a \right) & \text{if } (-\frac{l}{b} < x < 0)
\end{cases}
\]

\[
A_0 = \frac{1}{P} \int_P s(x) \, dx \\
A_n = \frac{2}{P} \int_P s(x) \cos \left( 2\pi \frac{n}{P} x \right) \, dx \quad \text{for } n \geq 1 \\
B_n = \frac{2}{P} \int_P s(x) \sin \left( 2\pi \frac{n}{P} x \right) \, dx \quad \text{for } n \geq 1
\]
GUI

- Python with tkinter for the gui development
- ECG window using tkinter
Phase 1

- Create functions that represent the waves
- Create multiple periods
- Animation for ECG
- ECG pattern
- Heart rate and other
Updates

- Plotting the coordinates
- Normal Rhythm completed and fixed some bugs
Next Goals

- Improve our UI
- Add more heart rhythms
- Add the option to change parameters in the gui