ELECTROMYOGRAM DIAGNOSIS SYSTEM FOR REHABILITATION USING SUPPORT VECTOR MACHINE

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1 INTRODUCTION

- The project develops an AI-based Electromyogram (EMG) diagnosis system using Support Vector Machine (SVM) to **classify muscle conditions** as healthy or unhealthy.
- **EMG data from real patients** and an **online dataset are used** to train and evaluate the system for accurate diagnosis.
- The system aims to support clinicians in **diagnosing muscle-related disorders** and **optimizing rehabilitation treatments**.

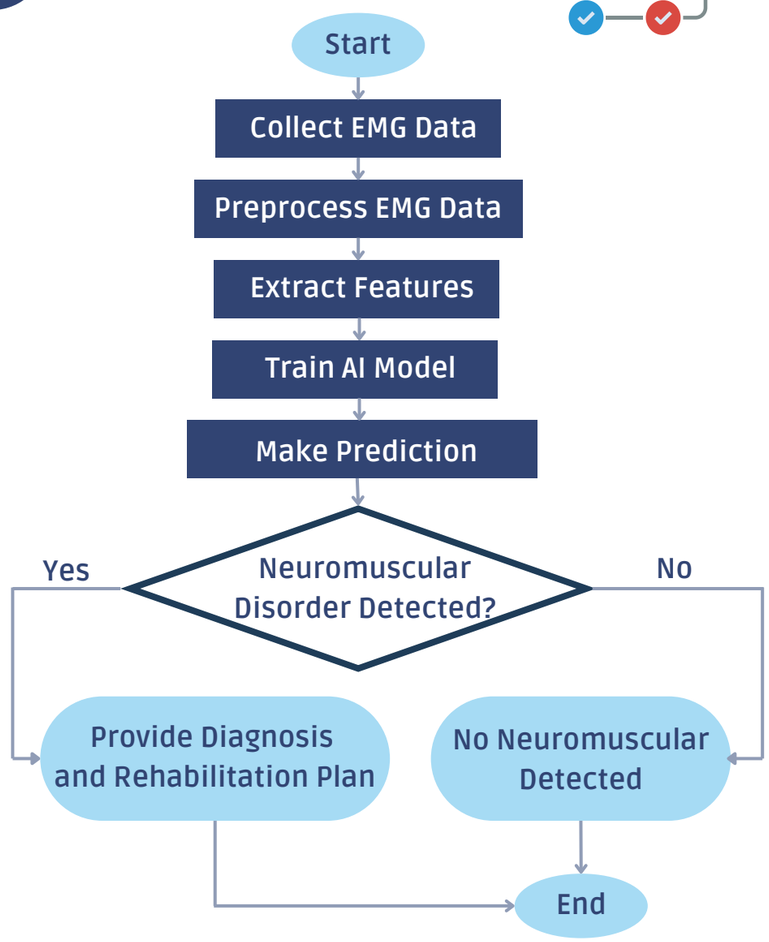
2 PROBLEM STATEMENT

Time-consuming

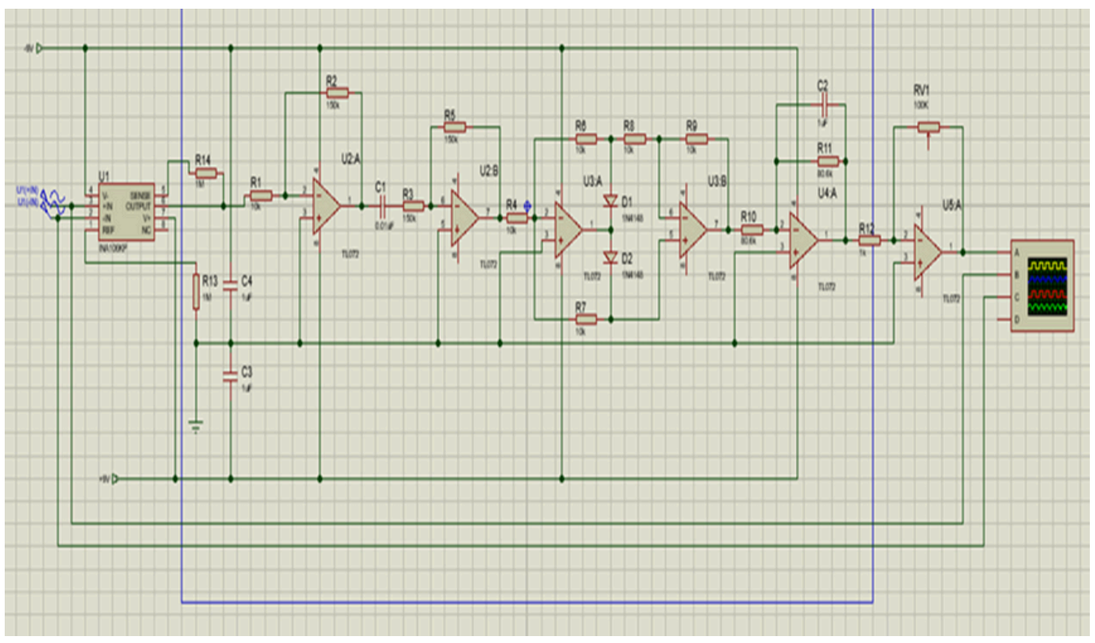
Shortage of specialized workers

Delay diagnosis

3 METHODOLOGY



4 CIRCUIT DESIGN



Gain formula,

$$A = \frac{Rsense + Rf}{Rinput}$$

$$A = \frac{100K\Omega + 1M\Omega}{10K\Omega} = 110$$

High pass filter formula,

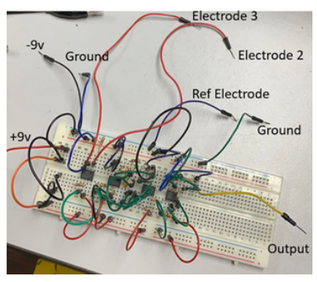
$$f_c = \frac{1}{2\pi RC} = \frac{1}{2\pi(80.6k)(1.0\mu)} = 2Hz$$

Low pass filter formula,

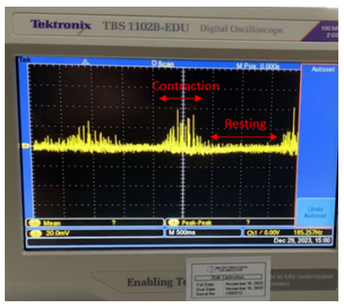
$$f_c = \frac{1}{2\pi RC} = \frac{1}{2\pi(150k)(0.01\mu)} = 106Hz$$

5 SYSTEM ARCHITECTURE

EMG Circuit



Data Collection



AI Predict Muscular Function

```
Feature matrix shape: (15, 13)
SVM Model Accuracy: 0.80
```

6 RESULT & DISCUSSION

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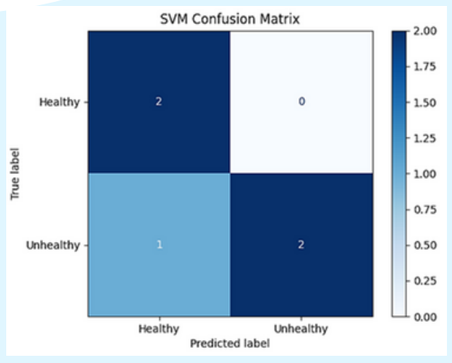
Feature matrix shape: (15, 13)
SVM Model Accuracy: 0.80
C:\Users\GUI ZHENG XUAN\PycharmProjects\pythonProject32\venv\lib\site-packages\keras\src\layers\convolutional\base_conv.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
2024-08-22 09:24:55.116307: I tensorflow/core/platform/cpu_feature_guard.cc:210] This TensorFlow binary is optimized to
To enable the following instructions: AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler fl
Epoch 1/5
4/4 ━━━━━━━━━━━━━━━━━━━━ 1s 45ms/step - accuracy: 0.4500 - loss: 15.1291 - val_accuracy: 0.0000e+00 - val_loss: 37.6094
Epoch 2/5
4/4 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.5500 - loss: 13.3655 - val_accuracy: 1.0000 - val_loss: 4.6908e-13
Epoch 3/5
4/4 ━━━━━━━━━━━━━━━━━━━━ 0s 9ms/step - accuracy: 0.4500 - loss: 10.8603 - val_accuracy: 0.5000 - val_loss: 4.7646
Epoch 4/5
4/4 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - accuracy: 0.5500 - loss: 4.7762 - val_accuracy: 1.0000 - val_loss: 2.1563e-05
Epoch 5/5
4/4 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.3667 - loss: 3.1398 - val_accuracy: 1.0000 - val_loss: 0.0011
CNN Model Accuracy: 0.40
```



$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} \times 100\% = \frac{2+2}{2+2+0+1} \times 100\% = 80\%$$

Precison (for the unhealthy calss):

$$= \frac{TN}{FP + FN} \times 100\% = \frac{2}{2+0} = \frac{2}{2} \times 100\% = 100\%$$

Recall (for the unhealthy class):

$$= \frac{TP}{TP + FN} \times 100\% = \frac{2}{2+1} = \frac{2}{3} \times 100\% = 67\%$$

$$Error\ Rate = 100\% - Accuracy = 20\%$$

TP: 2 (Unhealthy classified as Unhealthy)
TN: 2 (Healthy classified as Healthy)
FP: 0 (Healthy classified as Unhealthy)
FN: 1 (Unhealthy classified as Healthy)

7 IMPACT TO SOCIETY

Enhance Early Diagnosis & Treatment

Support for Healthcare Workers

SOCIETY

Improve Rehabilitation Outcomes

Advancement of Medical Technology

Accessibility & Cost-Effective Healthcare