**Main Implementation file:** Paper2HybridCombined\_V1.m

This file has been divided into these major sections

# Dataset Loading:

The dataset is loaded by the following portion of the code.

|  |
| --- |
| clc; clear all;  try  data = xlsread(Path to the dataset);  catch  error('Failed to load data from the Excel file.');  end |

# Select features and preprocess data

You need to select the desired features from the data, standardize it

|  |
| --- |
| input\_data = data(:, [2, 5, 7]); % Assuming columns 2, 5, and 7 correspond to frequency, magnitude, and angles, respectively  % Compute baseline model for moisture  MoistureBaseline = SingBaseline(input\_data);  % Standardize output data  .  .  .  % Display information about the data  disp('Data loaded and preprocessed successfully.'); |

HPA implementation section. You can adjust the settings here in this portion, a sample setting is specified

|  |
| --- |
| % Define your objective function  objective\_function = @(samples) objectiveFunction(samples, input\_data, response\_data, outputdataStandardized);  % Set the parameters for HPA  num\_samples = size(input\_data, 1);  lb = zeros(1, num\_samples);  ub = ones(1, num\_samples);  .  . |

# Run HPA

Now you give the standardized data to the HPA along with necessary parameters, this hybrid\_gwo\_abc\_bat function is the HPA implementation.

|  |
| --- |
| [selected\_samples, rmse] = hybrid\_gwo\_abc\_bat(objective\_function, num\_samples, lb, ub, num\_wolves, max\_iterations);  % Extract selected input combinations  selected\_indices = find(selected\_samples > 0);  selected\_combinations = input\_data(selected\_indices, :);  selected\_responses = response\_data(selected\_indices);  disp(['RMSE: ', num2str(rmse)]); |

Deploy the desired ML model LIKE GRU, LSTM and BILSTM,and CNN, Train and test it and compute performances metrices like RMSE, MAE and R-squared. the rest of the code

# HPA function code

|  |
| --- |
| function [selected\_samples, rmse] = hybrid\_gwo\_abc\_bat(objective\_function, num\_samples, lb, ub, num\_wolves, max\_iterations)  % Initialize the positions of the grey wolves randomly  wolves = randi([0, 1], num\_wolves, num\_samples);    % Evaluate the objective function for each wolf  fitness\_values = zeros(num\_wolves, 1);  .  .  .  .  .  .    % Update alpha, beta, and delta wolves  [sorted\_fitness, sorted\_indices] = sort(fitness\_values);  alpha\_wolf = wolves(sorted\_indices(1), :);  beta\_wolf = wolves(sorted\_indices(2), :);  delta\_wolf = wolves(sorted\_indices(3), :);    % Update iteration counter  iteration = iteration + 1;  end    % Return the best solution found by the hybrid algorithm  selected\_samples = alpha\_wolf;  rmse = sorted\_fitness(1);  end |

Workspace including Raw data: hybridfinal.mat

This is the complete workspace including the “Variable: Data” the represent the dataset instances. In order to get access to the data, this mat file is loaded by using

>> load('hybridfinal.mat')

Run this command in command window of any version of MATLAB. You can also export this variable to MS Excel to have an XLSX file.

Dataset

The dataset can be viewed at the following link/URL.

<https://drive.google.com/drive/folders/1h3VkejaWA6-WrleHcWyb4JZLvsGaK1L2?usp=sharing>

the viewer access is also provided to

[editorial.support@peerj.com](mailto:editorial.support@peerj.com)

Note: Source codes and the dataset will be made available to the researchers on reasonable request at [aliroman@ciitwah.edu.pk](mailto:aliroman@ciitwah.edu.pk).

MATLAB Requirements

The MATLAB must have parallel computing toolbox support, machine learning and deep learning toolbox support. If your MATLAB don’t have these toolboxes support, then you can not run the code. So first Install these toolboxes.

The code also requires a GPU device installed in the system. You can also run these codes on only CPU, but speed and performance will be affected. More computational time is required to perform operations.

**Individual implementation files:** The supplemental file SingBaseline.m is also uploaded to the portal.