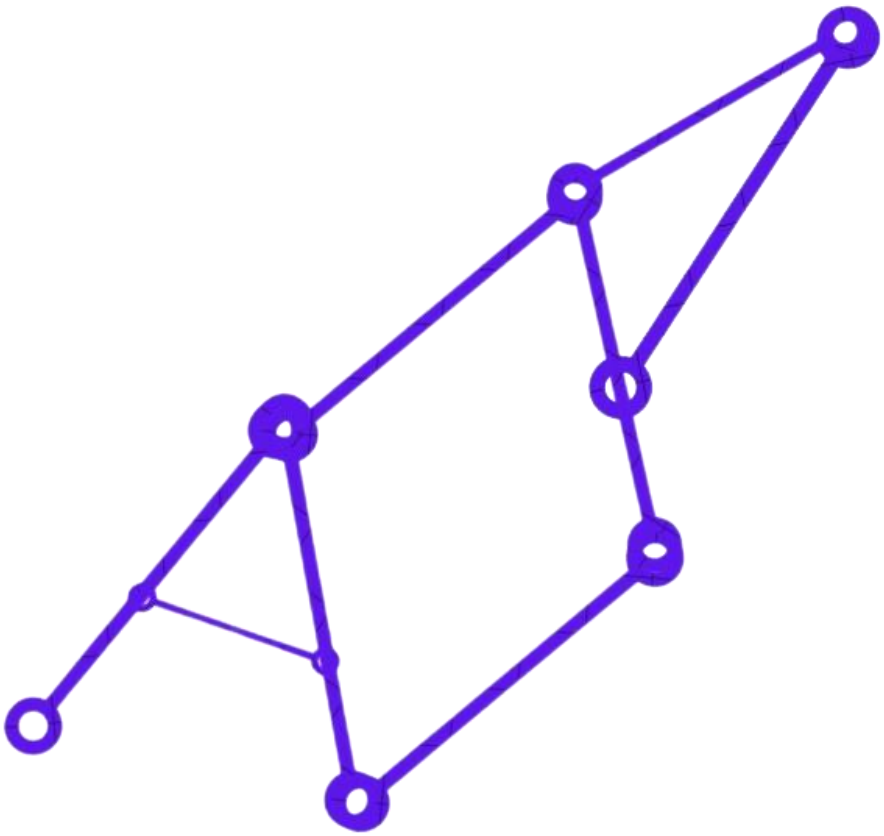

PYERUALJETWORK 4.0.2 USER MANUAL

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ABOUT PYERUALJETWORK:

PyerualJetwork is a machine learning library written in Python for professionals, incorporating advanced, unique, new, and modern techniques. Its most important component is the PLAN (Potentiation Learning Artificial Neural Network).

As of 12/21/2024, the library includes the PLAN and PLANEAT modules, but other machine learning modules are expected to be added in the future.

The PLAN algorithm will not be explained in this document. This document focuses on how professionals can integrate and use Pyerual Jetwork in their systems. However, briefly, the PLAN algorithm can be described as a classification algorithm. PLAN algorithm achieves this task with an incredibly energy-efficient, fast, and hyperparameter-free user-friendly approach. For more detailed information, you can check out

https://github.com/HCB06/PyerualJetwork/blob/main/Welcome_to_PLAN/PLAN.pdf

HOW DO I IMPORT IT TO MY PROJECT?

Anaconda users can access the 'Anaconda Prompt' terminal from the Start menu and add the necessary library modules to the Python module search queue by typing "pip install pyerualjetwork" and pressing enter. If you are not using Anaconda, you can simply open the 'cmd' Windows command terminal from the Start menu and type "pip install pyerualjetwork ". (Visual Studio Code reccomended) After installation, it's important to periodically open the terminal of the environment you are using and stay up to date by using the command "pip install pyerualjetwork --upgrade". The latest version was “4.0.2” at the time this document was written

After installing the module using "pip" you can now call the library module in your project environment. For example: “from pyerualjetwork import plan”. Now, you can call the necessary functions from the plan module.

LIBRARY ARCHITECTURE:

The functions of the PyerualJetwork modules, uses snake_case written style.

Main Modules and Functions:

1. **plan**
    a. fit()
    b. evaluate ()
    c. learner()
    d. get_weights ()
    e. get_scaler ()
    f. get_preds ()
    g. get_acc ()
    h. get_act_pot ()

2. **planeat**
    a. define_genoms()
    b. evaluate()
    c. learner()

Supportive Modules and Functions:

1. **data_operations**
    a. split()
    b. one_hot_encode()
    c. one_hot_decode()
    d. auto_balancer()
    e. manuel_balancer()
    f. synthetic_augmentation()
    g. standard_scaler()

2. **model_operations**
    a. save_model()
    b. load_model()
    c. predict_model_ram()
    d. predict_model_ssd()

e. reverse_predict_model_ram()
f. reverse_predict_model_ssd()

PLAN MODULE

It applies the PLAN (Potentiation Learning Artificial Neural Network) algorithm, which incorporates a unique learning architecture specifically designed by me to enhance "**explainability and efficiency of AI models."** This algorithm is based on my custom optimization approach, TFL (Test or Train Feedback Learning), which does not rely on the traditional Backpropagation method.
The advantage of this algorithm lies in its ability to create "super perceptrons." For example, imagine a perceptron achieving over 0.9 accuracy in classifying the circles dataset—this is something the PLAN module can achieve. The goal of this algorithm is to develop artificial neural network models that are **"as simple as a perceptron yet as powerful in learning capabilities as multi-layer perceptrons."**

PLAN MODULE FUNCTIONS

1. plan.fit()

The purpose of this function, as the name suggests, is to train the model.

```
a.      fit Args:
b.         x_train (list[num]): List or numarray of input data.
c.
d. y_train (list[num]): List or numarray of target labels. (one hot
   encoded)
e.
```

```
f. val (None or True): validation in training process ? None or True
   default: None (optional)
g.
h. val_count (None or int): After how many examples learned will an
   accuracy test be performed? default: 10=(%10) it means every
   approximately 10 step (optional)
i.
j. activation_potentiation (list): For deeper PLAN networks, activation
   function parameters. For more information please run this code:
   activation_functions.activations_list() default: [None] (optional)
k.
l. x_val (list[num]): List of validation data. default: x_train (optional)
m.
n. y_val (list[num]): (list[num]): List of target labels. (one hot encoded)
   default: y_train (optional)
o.
p. show_training (bool, str): True or None default: None (optional)
q.
r. LTD (int): Long Term Depression Hyperparameter for train PLAN neural
   network default: 0 (optional)
s.
t. interval (float, int): frame delay (milisecond) parameter for Training
   Report (show_training=True) This parameter effects to your Training
   Report performance. Lower value is more diffucult for Low end PC's
   (33.33 = 30 FPS, 16.67 = 60 FPS) default: 100 (optional)
u.
v. decision_boundary_status (bool): If the visualization of validation and
   training history is enabled during training, should the decision
   boundaries also be visualized? True or False. Default is True.
   (optional)
w.
x. train_bar (bool): Training loading bar? True or False. Default is True.
   (optional)
y.
z. auto_normalization(bool): Normalization process during training. May
   effect training time and model quality. True or False. Default is True.
   (optional)
aa.
bb.neurons_history (bool, optional): Shows the history of changes that
   neurons undergo during the CL (Cumulative Learning) stages. True or
   False. Default is False. (optional)
cc.
dd.    Returns:
ee.        numpyarray([num]): (Weight matrix).
```

The output of this function Weight matrix of model.

2. plan.evaluate()

This function calculates the test accuracy of the model using the inputs and labels set aside for testing, along with the weight matrices and other model parameters obtained as output from the training function.

```
a. x_test (list[num]): Test input data.
b.
c. y_test (list[num]): Test labels.
d.
e. W (list[num]): Weight matrix list of the neural network.
f.
g. activation_potentiation (list): For deeper PLAN networks, activation
   function parameters. For more information please run this function:
   'plan.activations_list()' default: ['linear']
h.
i. loading_bar_status:  Evaluate progress have a loading bar ? (True or
   False) Default: True.
j.
k. show_metrics (bool): (True or None) (optional) Default: None
```

The outputs of this function are, in order: weights of test process, a list of test predictions, and test accuracy rate.

3. plan.learner()

Optimizes the activation functions for a neural network by leveraging train data to find the most accurate combination of activation potentiation for the given dataset.

This next-generation generalization function includes an advanced learning feature that is specifically tailored to the PLAN algorithm.

It uniquely adjusts hyperparameters based on test accuracy while training with model-specific training data, offering an unparalleled optimization technique.

Designed to be used before model evaluation. This called TFL(Test or Train Feedback Learning).

```
    Args:
        x_train (array-like): Training input data.

        y_train (array-like): Labels for training data.

        x_test (array-like, optional): Test input data (for improve
    next gen generilization). If test data is not given then train
    feedback learning active

        y_test (array-like, optional): Test Labels (for improve next
    gen generilization). If test data is not given then train feedback
    learning active

        strategy (str, optional): Learning strategy. (options:
    'accuracy', 'loss', 'f1', 'precision', 'recall', 'adaptive_accuracy',
    'adaptive_loss', 'all'): 'accuracy', Maximizes test accuracy during
    learning. 'f1', Maximizes test f1 score during learning. 'precision',
    Maximizes test precision score during learning. 'recall', Maximizes
    test recall during learning. loss', Minimizes test loss during
    learning. 'adaptive_accuracy', The model compares the current
    accuracy with the accuracy from the past based on the number
    specified by the patience value. If no improvement is observed it
    adapts to the condition by switching to the 'loss' strategy quickly
    starts minimizing loss and continues learning. 'adaptive_loss',The
    model adopts the 'loss' strategy until the loss reaches or falls
    below the value specified by the patience parameter. However, when
    the patience threshold is reached, it automatically switches to the
    'accuracy' strategy and begins to maximize accuracy. 'all', Maximizes
    all test scores and minimizes test loss, 'all' strategy most strong
    and most robust strategy. Default is 'accuracy'.

        patience ((int, float), optional): patience value for
    adaptive strategies. For 'adaptive_accuracy' Default value: 5. For
    'adaptive_loss' Default value: 0.150.
```

```
m.
n.          depth (int, optional): The depth of the PLAN neural networks
    Aggreagation layers.
o.
p.          batch_size (float, optional): Batch size is used in the
    prediction process to receive test feedback by dividing the test data
    into chunks and selecting activations based on randomly chosen
    partitions. This process reduces computational cost and time while
    still covering the entire test set due to random selection, so it
    doesn't significantly impact accuracy. For example, a batch size of
    0.08 means each test batch represents 8% of the test set. Default is
    1. (%100 of test)
q.
r.          auto_normalization (bool, optional): If auto
    normalization=False this makes more faster training times and much
    better accuracy performance for some datasets. Default is True.
s.
t.          early_shifting (int, optional): Early shifting checks if the
    test accuracy improves after a given number of activation attempts
    while inside a depth. If there's no improvement, it automatically
    shifts to the next depth. Basically, if no progress, it’s like,
    “Alright, let’s move on!”  Default is False
u.
v.          early_stop (bool, optional): If True, implements early
    stopping during training.(If test accuracy not improves in two depth
    stops learning.) Default is False.
w.
x.          show_current_activations (bool, optional): Should it display
    the activations selected according to the current strategies during
    learning, or not? (True or False) This can be very useful if you want
    to cancel the learning process and resume from where you left off
    later. After canceling, you will need to view the live training
    activations in order to choose the activations to be given to the
    'start_this' parameter. Default is False
y.
z.          show_history (bool, optional): If True, displays the training
    history after optimization. Default is False.
aa.
bb.         loss (str, optional): For visualizing and monitoring. PLAN
    neural networks doesn't need any loss function in training(if
    strategy not 'loss'). options: ('categorical_crossentropy' or
    'binary_crossentropy') Default is 'categorical_crossentropy'.
cc.
dd.         interval (int, optional): The interval at which evaluations
    are conducted during training. (33.33 = 30 FPS, 16.67 = 60 FPS)
    Default is 100.
ee.
ff.         target_acc (int, optional): The target accuracy to stop
    training early when achieved. Default is None.
```

```
gg.
hh.         target_loss (float, optional): The target loss to stop
    training early when achieved. Default is None.
ii.
jj.         except_this (list, optional): A list of activations to
    exclude from optimization. Default is None. (For avaliable activation
    functions, run this function: plan.activations_list())
kk.
ll.         only_this (list, optional): A list of activations to focus on
    during optimization. Default is None. (For avaliable activation
    functions, run this code: plan.activations_list())
mm.
nn.         start_this (list, optional): To resume a previously canceled
    or interrupted training from where it left off, or to continue from
    that point with a different strategy, provide the list of activation
    functions selected up to the learned portion to this parameter.
    Default is None
oo.
pp.         neurons_history (bool, optional): Shows the history of
    changes that neurons undergo during the TFL (Test Feedback Learning)
    stages. True or False. Default is False.
qq.
rr.     Returns:
ss.         tuple: A list for model parameters: [Weight matrix, Test
    loss, Test Accuracy, [Activations functions]].
tt.
uu.
```

Returns: model(list)

4. plan.get_weights()

This function returns wight matrices list of the selected model. For exp:

test_model = plan.evaluate(x_test, y_test)

W = test_model[plan.get_weights()]

5. plan.get_scaler()

Returns scaler_params of the selected model For exp:

model = plan.learner(x_train, y_train, depth=10)

scaler_params = model[plan.get_scaler()]

6. plan.get_preds()

Returns predictions list of the selected model

7. plan.get_acc()

Returns accuracy of the selected model

8. plan.get_act_pot()

Returns activation potential of the selected model.

PLANEAT MODULE

The PLANEAT module represents a hybrid approach that combines the PLAN algorithm with the NEAT (Neuroevolution of Augmented Topologies) algorithm. PLANEAT is a hybrid algorithm designed for use in Reinforcement Learning problems as well as Genetic Optimization tasks. Its goal is to enhance the efficiency of traditional NEAT by focusing

on creating **PLAN-like models** without unnecessary layers and connections, similar to the activation-focused approach of the PLAN algorithm.

It is also designed to cater to all user groups by offering user-friendly preset modes alongside limitless configuration options for advanced users, ensuring satisfaction for a broad audience.

PLANEAT MODULE FUNCTIONS

1. planeat.define_genomes ()

Creates PLANEAT environment.

```
    Initializes a population of genomes, where each genome is represented by a set of weights

    and an associated activation function. Each genome is created with random weights and activation
    functions are applied and normalized. (Max abs normalization.)

    Args:
        input_shape (int): The number of input features for the neural network.
        output_shape (int): The number of output features for the neural network.
        population_size (int): The number of genomes (individuals) in the population.

    Returns:
        tuple: A tuple containing:
            - population_weights (numpy.ndarray): A 2D numpy array of shape (population_size, output_shape, input_shape) representing the
                weight matrices for each genome.
            - population_activations (list): A list of activation functions applied to each genome.
```

```
p.
q.    Raises:
r.        ValueError:
s.            - If the population size is odd (ensuring an even number of
   genomes is required for proper selection).
t.
u.    Notes:
v.        The weights are initialized randomly within the range [-1, 1].
w.        Activation functions are selected randomly from a predefined list
   `activations_list()`.
x.        The weights for each genome are then modified by applying the
   corresponding activation function
y.        and normalized using the `normalization()` function. (Max abs
   normalization.)
z.
```

2. planeat.evaluate ()

Making predicitons for each genome in single generation. (Or if rl_mode=True then making prediction for single genome.)

```
aa.    Evaluates the performance of a population of genomes, applying
   different activation functions
bb.    and weights depending on whether reinforcement learning mode is
   enabled or not.
cc.
dd.    Args:
ee.        x_population (list or numpy.ndarray): A list or 2D numpy array
   where each element represents
ff.a genome (A list of input features for each genome, or a single set of
   input features for one genome (only in rl_mode)).
gg.
hh.        weights (list or numpy.ndarray): A list or 2D numpy array of
   weights corresponding to each genome in `x_population`. This determines
   the strength of connections.
ii.
jj.        activation_potentiations (list or str): A list where each entry
   represents an activation function
kk.                                                or a potentiation
   strategy applied to each genome. If only one
ll.                                                activation function is
   used, this can be a single string.
```

```
mm.        rl_mode (bool, optional): If True, reinforcement learning mode
   is activated, this accepts x_population is a single genom. (Also weights
   and activation_potentations a single genomes part.)
nn.                                  Default is False.
oo.
pp.    Returns:
qq.        list: A list of outputs corresponding to each genome in the
   population after applying the respective
rr.              activation function and weights.
ss.
tt.    Notes:
uu.        - If `rl_mode` is True:
vv.            - Accepts x_population is a single genom
ww.            - The inputs are flattened, and the activation function is
   applied across the single genom.
xx.
yy.        - If `rl_mode` is False:
zz.            - Accepts x_population is a list of genomes
aaa.                - Each genome is processed individually, and the
   results are stored in the `outputs` list.
bbb.
ccc.             - `fex()` function is the core function that processes the
   input with the given weights and activation function.
ddd.
eee.         Example:
fff.             ```python
ggg.             outputs = evaluate(x_population, weights,
   activation_potentiations, rl_mode=False)
hhh.             ```
iii.
jjj.         - The function returns a list of outputs after processing the
   population, where each element corresponds to
kkk.           the output for each genome in `x_population`.
lll.
```

3. planeat.learner()

Applies (Adjust weight and actiavation parameters) PLANEAT algorithm for each genome in population.

```
mmm.         Applies the learning process of a population of genomes using
   selection, crossover, mutation, and activation function potentiation.
```

nnn. The function modifies the population's weights and activation functions based on a specified policy, mutation probabilities, and strategy.
ooo.
ppp. **Args:**
qqq. **weights (numpy.ndarray)**: Array of weights for each genoms. (first returned value of define_genomes function)
rrr.
sss. **activation_potentiations (list)**: A list of activation functions for each genomes. (second returned value of define_genomes function)
ttt.
uuu. **what_gen (int)**: The current generation number, used for informational purposes or logging.
vvv.
www. **y_reward (numpy.ndarray)**: A 1D array containing the fitness or reward values of each genome. The array is used to rank the genomes based on their performance. And PLANEAT maximize the reward.
xxx.
yyy. **show_info (bool, optional)**: If True, prints information about the current generation and the maximum reward obtained. Also shows current configuration. Default is False.
zzz.
aaaa. **strategy (str, optional)**: The strategy for combining the best and bad genomes. Options:
bbbb. - 'cross_over': Perform Two-Point Matrix Crossover between the best genomes and replace bad genomes. (Classic NEAT cross over)
cccc. - 'potentiate': Cumulate the weight of the best genomes and replace bad genomes. (PLAN feature. 'Like Arithmetic Crossover but different.') Default is 'cross_over'.
dddd.
eeee. **policy (str, optional)**: The selection policy that governs how genomes are selected for reproduction. Options:
ffff. - 'normal_selective':

gggg. Normal selection based on reward, where a portion of the bad genes are discarded.
hhhh. - 'more_selective': A more selective policy, where fewer bad genes survive.
iiii. - 'less_selective': A less selective policy, where more bad genes survive.
jjjj. Default is 'normal_selective'.
kkkk.
llll. **mutations (bool, optional)**: If True, mutations are applied to the bad genomes and potentially to the best genomes as well. Default is True.
mmmm. **bad_genoms_mutation_prob (float, optional)**: The probability of applying mutation to the bad genomes. Must be in the

range [0, 1]. Also effects best genoms mutatation prob. For example 0.7 value for bad genoms then 0.3 value for best genoms. Default is None, which means it is determined by the `policy` argument.
nnnn.
activation_mutate_prob (float, optional): The probability of applying mutation to the activation functions. Must be in the range [0, 1]. Default is 0.5 (% 50)

cross_over_mode (str, optional): Specifies the crossover method to use. Options:
- 'tpm': Two-Point Matrix Crossover
- 'plantic': plantic Crossover
Default is 'tpm'.

activation_add_prob (float, optional): The probability of adding a new activation function to the genome.
Must be in the range [0, 1]. Default is 0.5.

activation_delete_prob (float, optional): The probability of deleting an existing activation function
from the genome. Must be in the range [0, 1]. Default is 0.5.

activation_change_prob (float, optional): The probability of changing an activation function in the genome.
Must be in the range [0, 1]. Default is 0.5.

weight_mutate_prob (float, optional): The probability of mutating a weight in the genome.
Must be in the range [0, 1]. Default is 1.

weight_mutate_rate (int, optional): If the value you enter here is equal to the result of input layer * output layer,
only a single weight will be mutated during each mutation process. If the value you enter here is half
of the result of input layer * output layer, two weights in the weight matrix will be mutated.
WARNING: if you don't understand do NOT change this value. Default is 32.

activation_selection_add_prob (float, optional): The probability of adding an existing activation function for cross over.
from the genome. Must be in the range [0, 1]. Default is 0.5.

activation_selection_change_prob (float, optional): The probability of changing an activation function in the genome for cross over.
Must be in the range [0, 1]. Default is 0.5.

activation_selection_rate (int, optional): If the activation list of a good genome is smaller than the value entered here, only one activation will

```
undergo a crossover operation. In other words, this parameter controls the
model complexity. Default is 2.



save_best_genom (bool, optional): If True, ensures that the best genome are
saved and not mutated or altered during reproduction. Default is True.
oooo.
pppp.        Raises:
qqqq.            ValueError:
rrrr.                - If `policy` is not one of the specified values
   ('normal_selective', 'more_selective', 'less_selective').
ssss.
tttt.                - If `bad_genoms_mutation_prob`,
   `activation_mutate_prob`, or other probability parameters are not in the
   range [0, 1].
uuuu.                - If the population size is odd (ensuring an even
   number of genomes is required for proper selection).
vvvv.
wwww.
xxxx.        Returns:
yyyy.            tuple: A tuple containing:
zzzz.                - weights (numpy.ndarray): The updated weights for the
   population after selection, crossover, and mutation.
aaaaa.                                          The shape is
   (population_size, output_shape, input_shape).
bbbbb.               - activation_potentiations (list): The updated list of
   activation functions for the population.
ccccc.
ddddd.       Notes:
eeeee.           - **Selection Process**:
fffff.               - The genomes are sorted by their fitness (based on
   `y_reward`), and then split into "best" and "bad" half.
ggggg.               - The best genomes are retained, and the bad genomes
   are modified based on the selected strategy.
hhhhh.
iiiii.           - **Crossover and Potentiation Strategies**:
jjjjj.               - The **'cross_over'** strategy performs crossover,
   where parts of the best genomes' weights are combined with the other
   good genomes to create new weight matrices.
kkkkk.               - The **'potentiate'** strategy strengthens the best
   genomes by potentiating their weights towards the other good genomes.
lllll.
mmmmm.           - **Mutation**:
nnnnn.               - Mutation is applied to both the best and bad
   genomes, depending on the mutation probability and the `policy`.
ooooo.               - `bad_genoms_mutation_prob` determines the
   probability of applying mutations to the bad genomes.
```

```
ppppp.               - If `activation_mutate_prob` is provided, activation
   function mutations are applied to the genomes based on this probability.
qqqqq.
rrrrr.
sssss.
- **Policy Types**:

- **'normal_selective'**: A typical selection policy where a portion of the
bad genomes is discarded. The mutation probability for the bad genomes is
set to 0.7 by default.

- **'more_selective'**: A stricter selection policy where more of the bad
genomes are discarded. The mutation probability for the bad genomes is set
to 0.85 by default.

- **'less_selective'*
z*: A more lenient selection policy where fewer bad genomes are discarded.
The mutation probability for the bad genomes is set to 0.6 by default.

- **Population Size**: The population size must be an even number to
properly split the best and bad genomes. If `y_reward` has an odd length,
an error is raised.

- **Logging**: If `show_info=True`, the current generation and the maximum
reward from the population are printed for tracking the learning progress.

    Example:
ttttt.           ```python
uuuuu.           weights, activation_potentiations = learner(weights,
   activation_potentiations, 1, y_reward, info=True, strategy='cross_over',
   policy='normal_selective')
vvvvv.           ```
wwwww.
xxxxx.       - The function returns the updated weights and activations
   after processing based on the chosen strategy, policy, and mutation
   parameters.
yyyyy.      """
zzzzz.
```

DATA OPERATIONS MODULE FUNCTIONS

1. data_operations. auto_balancer()

This function aims to balance all training data according to class distribution before training the model. All data is reduced to the number of data points of the class with the least number of examples.

```
a.    x_train (list): Input data for training.
b.    y_train (list): Labels corresponding to the input data.
```

This function returns the following outputs in order: a list containing the balanced training data and a list containing the balanced training labels.

2. data_operations. synthetic_augmentation()

This function creates synthetic data samples with given data samples for balance data distribution.

```
a.     x -- Input dataset (examples) – array format
b.     y -- Class labels (one-hot encoded) - array format
```

This function returns the following outputs in order: a list containing the balanced training data and a list containing the balanced training labels. or testing labels.

3. data_operations. encode_one_hot()

```
a. Performs one-hot encoding on y_train and y_test data.
b.
c. Args:
d.
e. y_train (numpy.ndarray): Labeled train data.
f. y_test (numpy.ndarray): Labeled test data.
g. summary (bool): If True, prints the class-to-index mapping. Default:
   False
h.
```

Returns one hot encoded labels.

4. data_operations.split()

This function splits all data for train and test

```
a.          X (numpy.ndarray): Features data.
b.
c.          y (numpy.ndarray): Labels data.
d.
e.          test_size (float or int): Proportion or number of samples for
   the test subset.
f.
g.          random_state (int or None): Seed for random state.
```

Returns: x_train, x_test, y_train, y_test

5. data_operations. decode_one_hot()

```
a. encoded_data (numpy.ndarray): One-hot encoded data with shape
   (n_samples, n_classes).
```

Returns: decoded y_test given input

6. data_operations.manuel_balancer ()

Same operation of auto_balacner, but this function gives the limit of sample addition to user.

```
a.     x_train -- Input dataset (examples) - NumPy array format
b.
c.     y_train -- Class labels (one-hot encoded) - NumPy array format
d.
e.     target_samples_per_class -- Desired number of samples per class
```

Returns: x_train, y_train

7. data_operations.standard_scaler()

```
a. train_data: numpy.ndarray
b.
c. test_data: numpy.ndarray (optional)
d.
e. scaler_params (optional for using model)
```

Returns: If x_test given then returns: standart scaled parameters, standard scaled x_train, standard scaled y_test. If x_test is not given then returns: standard scaled parameters, standard scaled x_train.

MODEL OPERATIONS MODULE FUNCTIONS

1. model_operations.save_model ()

This function creates log files in the form of a pandas DataFrame containing all the parameters and information of the trained and tested model, and saves them to the specified location along with the weight matrices.

```
aaaaaa.  Function to save a potentiation learning model.
bbbbbb.
cccccc.      Arguments:
dddddd.
eeeeee.  model_name (str): Name of the model.
ffffff.
gggggg.  model_type (str): Type of the model. default: 'PLAN'
hhhhhh.
iiiiii.  test_acc (float): Test accuracy of the model. default: None
jjjjjj.
kkkkkk.  weights_type (str): Type of weights to save (options: 'txt',
   'pkl', 'npy', 'mat'). default: 'npy'
llllll.
mmmmmm.  weights_format (str): Format of the weights (options: 'f', 'raw').
   default: 'raw'
nnnnnn.
oooooo.  model_path (str): Path where the model will be saved. For example:
   C:/Users/beydili/Desktop/denemePLAN/ default: ''
pppppp.
qqqqqq.  scaler_params (list[num, num]): standard scaler params list:
   mean,std. If not used standard scaler then be: None.
rrrrrr.
ssssss.      W: Weights of the model.
tttttt.
uuuuuu.  activation_potentiation (list): For deeper PLAN networks,
   activation function parameters. For more information please run this
   code: activation_functions.activations_list() default: ['linear']
vvvvvv.
wwwwww.      Returns:
xxxxxx.      str: Message indicating if the model was saved successfully or
   encountered an error.
```

This function returns messages such as 'saved' or 'could not be saved' as output.

2. model_operations.load_model()

This function retrieves everything about the model into the Python environment from the saved log file and the model name.

```
a. model_name (str): Name of the model.
b. model_path (str): Path where the model is saved.
```

This function returns the following outputs in order: W, activation_potentiation, df (Data frame of model).

3. model_operations.predict_model_ssd()

This function loads the model directly from its saved location, predicts a requested input, and returns the output. (It can be integrated into application systems and the output can be converted to .json format and used in web applications.)

```
a. Input (list or ndarray): Input data for the model (single
   vector or single matrix).
b.
c. model_name (str): Name of the model.
d.
e. model_path (str):  Path of the model. Default: ‘’
```

This function returns the output layer of the model as the output of the given input.

4. model_operations.predict_model_ram()

This function predicts and returns the output for a requested input using a model that has already been loaded into the program (located in the computer's RAM). (It can be integrated into application systems and the output can be converted to .json format and used in web applications.) (Other parameters are information about the model and are defined as described and listed above.)

```
a.     Input (list or ndarray): Input data for the model (single vector or
   single matrix).
b.
c.     W (list of ndarrays): Weights of the model.
d.
e.     scaler_params (list): standard scaler params list: mean,std.
   (optional) Default: None.
f.
g.     activation_potentiation (list): ac list for deep PLAN. default:
   ['linear'] (optional)
```

This function returns the last output layer of the model as the output of the given input.

5. model_operations.reverse_predict_model_ssd()

This function loads the model directly from its saved location, predicts a requested output, and returns the input. It using reverse run.

```
a. output (list or ndarray): output layer for the model (single
   probability vector, output layer of trained model).
b.
c. model_name (str): Name of the model.
d.
e. model_path (str):  Path of the model. Default: ‘’
```

This function returns the input layer of the model as the input of the given output.

6. model_operations.reverse_predict_model_ram()

This function predicts and returns the input for a requested output using a model that has already been loaded into the program (located in the computer's RAM). It using reverse run.

```
a.      Input (list or ndarray): Input data for the model (single vector or
   single matrix).
b.
c.      W (list of ndarrays): Weights of the model.
d.
```

This function returns the last input layer of the model as the input of the given output.

LAST PART:

Despite being in its early stages of development, PyerualJetwork has already demonstrated its potential to deliver valuable services and solutions in the field of machine learning. Notably, it stands as the first library dedicated to PLAN (Potentiation Learning Artificial Neural Network), embracing innovation and welcoming new ideas from its users with open arms. Recognizing the value of diverse perspectives and fresh ideas, Hasan Can Beydili the creator of PyerualJetwork, am committed to fostering an open and collaborative environment where users can freely share their thoughts and suggestions. The most promising contributions will be carefully considered and potentially integrated into the PyerualJetwork library. For your suggestions, lists and feedback, my e-mail address is: tchasancan@gmail.com

Trust the PLAN…