My Project

Generated by Doxygen 1.8.17

Chapter 1

Namespace Index

1.1 Packages

Here are the packages with brief descriptions (if available):

EER . . . . ??
EER.EER . . . . ??
EER.filter_EER . . . . ??
EER.function . . . . ??
EER.image . . . . ??
EER.setting . . . . ??
main . . . . ??
modele_321 . . . . ??
modele_322 . . . . ??

Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

EER.image.Image
Class Image . . . . **??**
EER.function.Person
Class Person . . . . **??**

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

Attack/main.py . . . . ??
Attack/modele_321.py . . . . ??
Attack/modele_322.py . . . . ??
EER/__init__.py . . . . ??
EER/EER.py . . . . ??
EER/filter_EER.py . . . . ??
EER/function.py . . . . ??
EER/image.py . . . . ??
EER/setting.py . . . . ??

Chapter 4

Namespace Documentation

4.1 EER Namespace Reference

Namespaces

- EER
- filter_EER
- function
- image
- setting

4.2 EER.EER Namespace Reference

Functions

- def EER (FRR, FAR, number_threshold, images)

  EER function, calculate the EER and the threshold with the FAR and FRR gives and show the graph.
- def EER_file (file_FRR, file_FAR, number_threshold)

  EER_file function, call EER function with the data in the files gives in parameter.
- def EER_start (images, number_threshold)

  EER_start function, call FRR, FAR and EER function.
- def FAR (images)

  FAR function, calculate all the distance template for all couple of image with a different user.
- def FRR (images)

  FRR function, calculate all the distance template for all couple of image with the same user.
- def make_folder (attacker, last_folder)

  make_folder function, make a list of folders for save data with write function.

Variables

- images = create_all_images(path, size_template, size_image, size_image)
- int number_threshold = 1000
- string path = '../BDD/image/DB1_B/'
- int size_image = -1
- int size_template = 64
- start = time()

4.2.1 Detailed Description

File EER Contain functions use to calculate EER with the distance between template.

4.2.2 Function Documentation

4.2.2.1 EER()

```
def EER.EER.EER (
              FRR,
              FAR,
              number_threshold,
              images )
```

EER function, calculate the EER and the threshold with the FAR and FRR gives and show the graph.

Parameters

FRR	list Image object. Normally use all the image of the database.
FAR	list Image object. Normally use all the image of the database.
number_threshold	the number of threshold calculate. Greater he is more the result is accurate.
images	list Image object. Normally use all the image of the database.

Returns

the distance limit to accept user autentification.

4.2.2.2 EER_file()

```
def EER.EER.EER_file (
              file_FRR,
              file_FAR,
              number_threshold )
```

EER_file function, call EER function with the data in the files gives in parameter.

Not use now

Parameters

file_FRR	file path for find data of FRR.
file_FAR	file path for find data of FAR.
number_threshold	the number of threshold calculate. Greater he is more the result is accurate.

Returns

the distance limit to accept user autentification.

4.2.2.3 EER_start()

```
def EER.EER.EER_start (
              images,
              number_threshold )
```

EER_start function, call FRR, FAR and EER function.

Parameters

images	list Image object. Normally use all the image of the database.
number_threshold	the number of threshold calculate. Greater he is more the result is accurate but up the time execution too.

Returns

the distance limit to accept user authentification.

4.2.2.4 FAR()

```
def EER.EER.FAR (
              images )
```

FAR function, calculate all the distance template for all couple of image with a different user.

Parameters

images	list Image object. Normally use all the image of the database.

Returns

the list of distance templace calculate.

4.2.2.5 FRR()

```
def EER.EER.FRR (
              images )
```

FRR function, calculate all the distance template for all couple of image with the same user.

Parameters

images	list Image object. Normally use all the image of the database.

Returns

the list of distance templace calculate.

4.2.2.6 make_folder()

```
def EER.EER.make_folder (
              attacker,
              last_folder )
```

make_folder function, make a list of folders for save data with write function.

The path is /EER_template/bdd_***/template_***/image_***x***/FAR/.

Parameters

attacker	Image object of the attacker. Use for the size of the image.
last_folder	is a string and the last folder add to the list. Actually use for add FRR or FAR folder

Returns

the list of folder, ["EER_template","bdd_***","template_***","image_***x***","FAR"]

4.2.3 Variable Documentation

4.2.3.1 images

```
EER.EER.images = create_all_images(path, size_template, size_image, size_image)
```

4.2.3.2 number_threshold

```
int EER.EER.number_threshold = 1000
```

4.2.3.3 path

```
string EER.EER.path = '../BDD/image/DB1_B/'
```

4.2.3.4 size_image

```
int EER.EER.size_image = -1
```

4.2.3.5 size_template

```
int EER.EER.size_template = 64
```

4.2.3.6 start

```
EER.EER.start = time()
```

4.3 EER.filter_EER Namespace Reference

Functions

- def EER (FRR, FAR, max_threshold)
- def EER_file (file_FRR, file_FAR, max_threshold)
- def EER_start (images, max_threshold)
- def FAR (images)
- def FRR (images)
- def make_folder (attacker, last_folder)

Variables

- string BDD = path.split("/")[-2]
- string file = "0_test.csv"
- list first_256 = [51.749,43.346,41.94,38.866,39.163]
- list full_256 = [51.177,48.157,55.698,15.031,44.877]
- list images = [0]∗80
- images_bdd = create_all_images(path, 64, 10, 10)
- int max_threshold = 1000
- number = split('_| ', file)
- string path = '../BDD/image/DB1_B/'
- list second_256 = [51.732,50.793,46.36,36.583,37.551]
- int size_image = -1
- int size_template = 256
- start = time()

4.3.1 Detailed Description

File filter_EER Contain functions use to calculate EER with the distance between feature. Almost all the function have the same functioning than the funcion in EER file.

4.3.2 Function Documentation

4.3.2.1 EER()

```
def EER.filter_EER.EER (
              FRR,
              FAR,
              max_threshold )
```

4.3.2.2 EER_file()

```
def EER.filter_EER.EER_file (
              file_FRR,
              file_FAR,
              max_threshold )
```

4.3.2.3 EER_start()

```
def EER.filter_EER.EER_start (
              images,
              max_threshold )
```

4.3.2.4 FAR()

```
def EER.filter_EER.FAR (
              images )
```

4.3.2.5 FRR()

```
def EER.filter_EER.FRR (
              images )
```

4.3.2.6 make_folder()

```
def EER.filter_EER.make_folder (
              attacker,
              last_folder )
```

4.3.3 Variable Documentation

4.3.3.1 BDD

```
string EER.filter_EER.BDD = path.split("/")[-2]
```

4.3.3.2 file

```
string EER.filter_EER.file = "0_test.csv"
```

4.3.3.3 first_256

```
list EER.filter_EER.first_256 = [51.749,43.346,41.94,38.866,39.163]
```

4.3.3.4 full_256

```
list EER.filter_EER.full_256 = [51.177,48.157,55.698,15.031,44.877]
```

4.3.3.5 images

```
list EER.filter_EER.images = [0]*80
```

4.3.3.6 images_bdd

```
EER.filter_EER.images_bdd = create_all_images(path, 64, 10, 10)
```

4.3.3.7 max_threshold

```
int EER.filter_EER.max_threshold = 1000
```

4.3.3.8 number

```
EER.filter_EER.number = split('_| ', file)
```

4.3.3.9 path

```
string EER.filter_EER.path = '../BDD/image/DB1_B/'
```

4.3.3.10 second_256

```
list EER.filter_EER.second_256 = [51.732,50.793,46.36,36.583,37.551]
```

4.3.3.11 size_image

```
int EER.filter_EER.size_image = -1
```

4.3.3.12 size_template

```
int EER.filter_EER.size_template = 256
```

4.3.3.13 start

```
EER.filter_EER.start = time()
```

4.4 EER.function Namespace Reference

Classes

- class Person

    Class Person.

Functions

- def add_plot (lines_tab, names_tab, ax, i, j, ylabel, abscisse=-1)

  add_plot function, add plot in the subplot given.
- def all_images (path)

  all_images function, create a list with all images find in a folder.
- def all_images_name (path)

  all_images_name function, create a list with all names files in a folder.
- def binarisation_no_class (R)

  binarisation_no_class function, calculate the template with the result obtain after projection.
- def blurry_image (attacker)

  blurry_image function, make a mean of the four pixel around each pixel to make a new value.
- def calcul_EER_lines (FRR, FAR, max_threshold)

  calcul_EER_lines function, with value of distance obtain in FAR and FRR calculate the far and frr percent authentication.
- def copy_home (tab)

  copy_home function, copy_home make a copy of a two dimension list.
- def create_file_data_name (name_algorithm, number_file, parameter, add_number_file=False, add_↩ extension=False)

  create_file_data_name function, create a name file for save data of multiple attack by algorithm gives in name_↩ algorithm parameter.
- def create_file_data_name_list (name_algorithm, number, parameter_list)

  create_file_data_name_list function, create a list of name file for load data of multiple attack by genetic algorithm.
- def create_file_image_name (weightI, start_distance_template, person)

  create_file_image_name function, create a name file for save image.
- def create_parameter_list (tab, index, constant_parameter_list)

  create_parameter_list function, create a list of parameter_list to be used in graph_multiple_parameter_file function.
- def create_path (root, new_folders)

  create_path function, create a path with the root and the list of folders given and create the folder if isn't exist.
- def distance_feature_norm (F1, F2, width)

  distance_feature_norm function, calculate the distance normalize between two feature.
- def distance_image_norm (I1, I2)

  distance_image_norm function, calculate the distance normalize between two image.
- def distance_template_norm (T1, T2)

  distance_template_norm function, calculate the distance normalize between two template.
- def exchange (list, i, j)

  exchange function, exchange two value in a list.
- def find_nb_file (path, name_file)

  find_nb_file function, find the number of file with the same name without the number in suffix.
- def find_nb_file_avaible (path, name_file)

  find_nb_file_avaible function, find a number suffix not use in the folder for the name file given.
- def graph_multiple_parameter (folder, start_distance, tab_parameter, min_mean_max, time, xlabel, name, number_file=-1, quantile=0)

  graph_multiple_parameter function, use for make and save graph with data of result obtain with different parameter.
- def graph_multiple_parameter_file (folder, start_distance, tab_parameter, number, parameter_list, xlabel, name, line_solution=0, quantile=0)

  graph_multiple_parameter_file function, retrieve name file and data for use graph_multiple_parameter function.
- def heatmap_distance (distance_couple, images, threshold=-1, subtitle="")

  heatmap_distance function, make show and save the heatmap of the distance given.
- def heatmap_time_execution (time_couple, images, time_limit, subtitle="")

  heatmap_time_execution function, make the heatmap of the time of execution.
- def make_subplot (lines_tab, names_tab, main_title, title_plot, xlabel, ylabel, abscisse=-1, ylim=-1)

make_subplot function, make, show and save a subplot 2 by 2 with curves store in a list.

- def print_EER (index, max_threshold, frr, far)

  print_EER function, Print the value of false reject, false acceptance, distance and the mean between the far and frr for the threshold chosen and one before and after.
- def print_tab (tab)

  print_tab function, print each row of a list.
- def projection_no_class (F, M)

  projection_no_class function, make the projection with the vector of feature and the matrix of the user.
- def random_image (n, m)

  random_image function, create a random image with value between 0 and 255.
- def retrieve_first_row_from_file (file)

  retrieve_first_row_from_file function, return the first row of the file given.
- def retrieve_tab_from_file (file)

  retrieve_tab_from_file function, return all the row of the file given in a list.
- def retrive_user (name_image)

  retrive_user function, retrieve the user number with the name of the file.
- def save_image_attacker_and_target (path, attacker, target)

  save_image_attacker_and_target function, save the original digital print of the attacker and the target in the folder.
- def save_plot (tab, file)

  save_plot function, save a graph in a name file given with the data store in a list.
- def search_folder (folder)

  search_folder function, retrieve in which parents folders the folder given is.
- def set_heatmap_grid (nb_images, plot)

  set_heatmap_grid function, set the grid in the heatmap to separate same user and different user in the heatmap.
- def show_EER (frr, far, max_threshold, title, eer, threshold)

  show_EER function, make a graph of the FAR, FRR, EER and threshold optimum for the authentification.
- def show_image (image)

  show_image function, show the image given.
- def show_line (line, name)

  show_line function, show the graph of a line with sorted value.
- def show_plot (lines_tab, names_tab, title, xlabel, ylabel, abscisse=-1)

  show_plot function, make show and save the plot create with all the curves given.
- def sobel_filter_no_class (im)

  sobel_filter_no_class function, make the sobel filter on the image to make a vector of feature.
- def template_no_class (im, M)

  template_no_class function, calculate the template with the image and the matrix of projection.
- def variation_image (attacker, delta)

  variation_image function, make a variation in all pixel of the image.
- def write (tab, new_folder, attacker=None, target=None, name="", extention=".csv", number_file=-1)

  write function, use for save data, image or graph depending of the extention in the parameter.

4.4.1 Function Documentation

4.4.1.1 add_plot()

```
def EER.function.add_plot (
              lines_tab,
              names_tab,
              ax,
              i,
              j,
              ylabel,
              abscisse = -1 )
```

add_plot function, add plot in the subplot given.

Use in make_subplot function.

Parameters

lines_tab	list of all curves to be add in the sub plot. A curves is a list of data.
names_tab	list of name for all curves.
ax	the main plot.
i	the line in the main plot for the new sub plot.
j	the column in the main plot for the new sub plot.
ylabel	the ylabel of the plot.
abscisse	the list of value use in abscisse. default value -1 set the abscisse to the number between 1 and the number of data in the curve.

4.4.1.2 all_images()

```
def EER.function.all_images (
              path )
```

all_images function, create a list with all images find in a folder.

Parameters

path,string	value of the path of the folder. Exemple '../../BDD/image/DB1_B/'

Returns

the list of images create.

4.4.1.3 all_images_name()

```
def EER.function.all_images_name (
              path )
```

all_images_name function, create a list with all names files in a folder.

Parameters

path,string	value of the path of the folder. Exemple '../../BDD/image/DB1_B/'

Returns

the list of names files.

4.4.1.4 binarisation_no_class()

```
def EER.function.binarisation_no_class (
              R )
```

binarisation_no_class function, calculate the template with the result obtain after projection.

Parameters

R	the result obtain after projection.

Returns

the template calculate.

4.4.1.5 blurry_image()

```
def EER.function.blurry_image (
              attacker )
```

blurry_image function, make a mean of the four pixel around each pixel to make a new value.

Use for some test in genese in genetic algorithm. Not usefull.

Parameters

attacker	Image object of attacker.

Returns

the image create.

4.4.1.6 calcul_EER_lines()

```
def EER.function.calcul_EER_lines (
              FRR,
              FAR,
              max_threshold )
```

calcul_EER_lines function, with value of distance obtain in FAR and FRR calculate the far and frr percent authentication.

Parameters

FRR	all the distance between all the couple with the same user.
FAR	all the distance between all the couple with a different user.
max_threshold	number of treshold to calculate the percent of authentification for each threshold. Greater he is more accurate is the result but the time of execution is greater too.

Returns

the two list of authentification percent for all threshold, for false acceptance and false reject.

4.4.1.7 copy_home()

```
def EER.function.copy_home (
              tab )
```

copy_home function, copy_home make a copy of a two dimension list.

Parameters

tab	the two dimension list.

Returns

the copy make.

4.4.1.8 create_file_data_name()

```
def EER.function.create_file_data_name (
              name_algorithm,
              number_file,
              parameter,
              add_number_file = False,
              add_extension = False )
```

create_file_data_name function, create a name file for save data of multiple attack by algorithm gives in name_algorithm parameter.

Exemple create_file_data_name("genetic", 0, [5,10,0.03,0.1], True, True) create_file_data_name("gradiant", 0, [0.1,100], True, True)

Parameters

name_algorithm	the name of the algorithm use.
number	the number suffix use to retrieve file.
parameter	a list of parameter use to save the file. The list depend of the algorithm use, genetic have 4 parameter, gradiant 2.
add_number_file	boolean to know if the number_suffix is add at the start of the file. Default value False.
add_extension	boolean to know if the extension is add at the end of the file. Default value False.

Returns

the list of name file create.

4.4.1.9 create_file_data_name_list()

```
def EER.function.create_file_data_name_list (
              name_algorithm,
              number,
              parameter_list )
```

create_file_data_name_list function, create a list of name file for load data of multiple attack by genetic algorithm.

Exemple create_file_data_name_list("genetic", 0, [[5,5,0.03,0.1],[5,10,0.03,0.1],[5,15,0.03,0.1],[5,20,0.03,0.1]]) create_file_data_name_list("gradiant", 0, [[0,100],[0.1,100],[[0.2,100],[[0.3,100],[0.4,100])

Parameters

name_algorithm	the name of the algorithm use.
number	the number suffix use to retrieve file.
parameter_list	a list of parameter use to save the file. A parameter is [max_while, number_select, proba_mutation, weightI] and parameter_list is a list of this. The function create_parameter_list was create to create this.

Returns

the list of name file create.

4.4.1.10 create_file_image_name()

```
def EER.function.create_file_image_name (
              weightI,
              start_distance_template,
              person )
```

create_file_image_name function, create a name file for save image.

Parameters

weightI	the weight of the image in the objective function.
start_distance_template	the distance template before running any attack.
person	a Person object of the result of the attack.

Returns

the name file create.

4.4.1.11 create_parameter_list()

```
def EER.function.create_parameter_list (
              tab,
              index,
              constant_parameter_list )
```

create_parameter_list function, create a list of parameter_list to be used in graph_multiple_parameter_file function.

Exemple : create_parameter_list([5,10,15,20], 1, [5,None,0.03,0.1]) return [[5,5,0.03,0.1],[5,10,0.03,0.1],[5,15,0.↩ 03,0.1],[5,20,0.03,0.1]]

Parameters

tab	the list of the variation of one parameter. Exemple use for number_select [5,10,15,20].
index	the index of the parameter use in tab. Exemple number_select index 1 for genetic algorithm. See create_file_data_name function to know the different index.
constant_parameter_list	the list of value for other parameter the value in the index has no importance. Exemple [5,None,0.03,0.1].

Returns

the list of parameter create.

4.4.1.12 create_path()

```
def EER.function.create_path (
              root,
              new_folders )
```

create_path function, create a path with the root and the list of folders given and create the folder if isn't exist.

Parameters

root	string value of the root of the path. Exemple "result"
new_folders	the list of folder to add to the root. Exemple ["genetic","bdd_DB1_B","template_64","image_374x388","attack_∗∗∗->∗∗∗","target_matrix"]

Returns

the path create. Exemple "./../../result/genetic/bdd_DB1_B/template_64/image_374x388/attack_∗∗∗->∗∗∗/target_matrix/".

4.4.1.13 distance_feature_norm()

```
def EER.function.distance_feature_norm (
              F1,
              F2,
              width )
```

distance_feature_norm function, calculate the distance normalize between two feature.

The distance is the square root of the sum of the square of the difference.

Parameters

F1	the first feature.
F2	the second feature.

Returns

the distance calculate.

4.4.1.14 distance_image_norm()

```
def EER.function.distance_image_norm (
              I1,
              I2 )
```

distance_image_norm function, calculate the distance normalize between two image.

The distance is the sum of the difference.

Parameters

I1	the first image.
I2	the second image.

Returns

the distance calculate.

4.4.1.15 distance_template_norm()

```
def EER.function.distance_template_norm (
              T1,
              T2 )
```

distance_template_norm function, calculate the distance normalize between two template.

The distance is the sum of the difference.

Parameters

T1	the first template.
T2	the second template.

Returns

the distance calculate.

4.4.1.16 exchange()

```
def EER.function.exchange (
              list,
              i,
              j )
```

exchange function, exchange two value in a list.

Parameters

list	the list.
i	the first index.
j	the second index.

Returns

nothing.

4.4.1.17 find_nb_file()

```
def EER.function.find_nb_file (
              path,
              name_file )
```

find_nb_file function, find the number of file with the same name without the number in suffix.

Use in write function. For name file image.bmp 0_image.bmp gonna increse the count.

Parameters

path	the path for the folder in a string.
name_file	the name file to count the number of file. Exemple image.bmp.

Returns

the number of file

4.4.1.18 find_nb_file_avaible()

```
def EER.function.find_nb_file_avaible (
              path,
              name_file )
```

find_nb_file_avaible function, find a number suffix not use in the folder for the name file given.

Use in write function. For name file image.bmp and 0_image.bmp, 1_image.bmp, 3_image.bmp return 2 is avaible

Parameters

path	the path for the folder in a string.
name_file	the name file to count the number of file. Exemple image.bmp.

Returns

a number suffix avaible.

4.4.1.19 graph_multiple_parameter()

```
def EER.function.graph_multiple_parameter (
              folder,
              start_distance,
              tab_parameter,
              min_mean_max,
              time,
              xlabel,
              name,
              number_file = -1,
              quantile = 0 )
```

graph_multiple_parameter function, use for make and save graph with data of result obtain with different parameter.

Parameters

folder	list of string with the folders to save graph.
start_distance	the distance template before the attack and the modification of the image attaker.
tab_parameter	list of different parameter use. Exemple with delta parameter [10,50,100,200].
min_mean_max	list of three list the first is the min value obtain in the result, the seond is the mean value and the third is the max value.
time	list of time execution.
xlabel	string to put in the xlabel of the graph. Example "Parameter Delta"
name	the name of the graph.
quantile	percent of quantile to delete extreme value. Exemple 0.01 will delete the min 1% and the max 1% value to keep 98% of the values. Not use for the moment.

4.4.1.20 graph_multiple_parameter_file()

```
def EER.function.graph_multiple_parameter_file (
                folder,
                start_distance,
                tab_parameter,
                number,
                parameter_list,
                xlabel,
                name,
                line_solution = 0,
                quantile = 0 )
```

graph_multiple_parameter_file function, retrieve name file and data for use graph_multiple_parameter function.

If it's necessary a complete exemple of how use this function is in the function test_parameter in the genetique file.

Parameters

folder	list of string with the folders to save graph.
start_distance	the distance template before the attack and the modification of the image attaker.
tab_parameter	list of different parameter use. Exemple with delta parameter [10,50,100,200].
number	the number suffix use to retrieve file.
parameter_list	a list of parameter use to save the file. for genetic a parameter is [max_while, number_select, proba_mutation, weightl] and parameter_list is a list of this.
xlabel	string to put in the xlabel of the graph. Example "Parameter Delta"
name	the name of the graph.
line_solution	the line retrive in the file. Default value 0 is the line of the distance image, 1 is the distance template.
quantile	percent of quantile to delete extreme value. Exemple 0.01 will delete the min 1% and the max 1% value to keep 98% of the values.

4.4.1.21 heatmap_distance()

```
def EER.function.heatmap_distance (
              distance_couple,
              images,
              threshold = -1,
              subtitle = "" )
```

heatmap_distance function, make show and save the heatmap of the distance given.

Parameters

distance_couple	list in two dimension of the distance between couple. Can use distance image, template, before or after an attack.
images	list of Image object.
threshold	the value use by the system to accept authentification. Default value -1 set "skyblue" color for the distance equal to 0. if != -1 set the distance $<$ threshold in "skyblue" color.
subtitle	string add to the start of the title. Default value "".

4.4.1.22 heatmap_time_execution()

```
def EER.function.heatmap_time_execution (
              time_couple,
              images,
              time_limit,
              subtitle = "" )
```

heatmap_time_execution function, make the heatmap of the time of execution.

Make for the quadratic model this functionmust be modified for other attack. Set "skyblue" for time $<$ 1sec, "green" the attack is out of time(time_limit+1), "black" if the solution is infeasable (time_limit+2) and a degraded of red for the rest.

Parameters

time_couple	list in two dimension of all time of execution of every couple in the database.
images	list of Image object.
time_limit	the time limit accepted by the attack.
subtitle	string add to the start of the title. Default value "".

4.4.1.23 make_subplot()

```
def EER.function.make_subplot (
              lines_tab,
              names_tab,
              main_title,
              title_plot,
              xlabel,
              ylabel,
              abscisse = -1,
              ylim = -1 )
```

make_subplot function, make, show and save a subplot 2 by 2 with curves store in a list.

This fucntion was create to show all the graph of graph_multiple_parameter easier. If it's necessary a complete exemple of how use this function is in the function test_parameter in the genetique file.

Parameters

lines_tab	list of all plot curve to be add in the main plot. A plot curve is a list of curve. A curves is a list of data.
names_tab	list of name for all curves.
main_title	the title of the main plot.
title_plot	the list of title for all the sub plot.
xlabel	the xlabel of the plot. Not use for the moment.
ylabel	the ylabel of the plot.
abscisse	the list of abscisse use in the different sub_plot. Abscisse contain a list of value use in abscisse or -1. Default value -1 set the abscisse to the number between 1 and the number of data in the curve.

4.4.1.24 print_EER()

```
def EER.function.print_EER (
              index,
              max_threshold,
              frr,
              far )
```

print_EER function, Print the value of false reject, false acceptance, distance and the mean between the far and frr for the threshold chosen and one before and after.

Parameters

index	the index of the optimum threshold calculate.
max_threshold	number of threshold calculate. Not necessary gonna be delete in the future.
frr	the percent of reject for all threshold with couple with the same user
far	the percent of authentification for all threshold with couple with diffferent user

Returns

nothing.

4.4.1.25 print_tab()

```
def EER.function.print_tab (
              tab )
```

print_tab function, print each row of a list.

Parameters

tab	the list to print.

4.4.1.26 projection_no_class()

```
def EER.function.projection_no_class (
              F,
              M )
```

projection_no_class function, make the projection with the vector of feature and the matrix of the user.

Parameters

F	the vector of feature.
F2	the matrix of the user.

Returns

the result obtain.

4.4.1.27 random_image()

```
def EER.function.random_image (
              n,
              m )
```

random_image function, create a random image with value between 0 and 255.

Parameters

n	the number of line in the image.
m	the number of column in the image.

Returns

the image create.

4.4.1.28 retrieve_first_row_from_file()

```
def EER.function.retrieve_first_row_from_file (
              file )
```

retrieve_first_row_from_file function, return the first row of the file given.

Not use for the moment.

Parameters

file	the path to the file.

Returns

the first row of the file.

4.4.1.29 retrieve_tab_from_file()

```
def EER.function.retrieve_tab_from_file (
              file )
```

retrieve_tab_from_file function, return all the row of the file given in a list.

Parameters

file	the path to the file.

Returns

the list with all row of the file.

4.4.1.30 retrive_user()

```
def EER.function.retrive_user (
              name_image )
```

retrive_user function, retrieve the user number with the name of the file.

Work with the database DB1_B and DB2_B.

Parameters

name_image	the name of the digital print image.

Returns

the number of user find in the name_image.

4.4.1.31 save_image_attacker_and_target()

```
def EER.function.save_image_attacker_and_target (
              path,
              attacker,
              target )
```

save_image_attacker_and_target function, save the original digital print of the attacker and the target in the folder.

Use in write function.

Parameters

path	the path for the folder in a string.
attacker	Image object of the attacker.
target	Image object of the target.

4.4.1.32 save_plot()

```
def EER.function.save_plot (
              tab,
              file )
```

save_plot function, save a graph in a name file given with the data store in a list.

Use in the write function. Actually work only with a graph with only one line. Not very usefull at the moment.

Parameters

tab	the data use to make the graph. exemple of list[line, abscisse=[], name_line, title, xlabel, ylabel].
file	the path to save the graph.

4.4.1.33 search_folder()

```
def EER.function.search_folder (
              folder )
```

search_folder function, retrieve in which parents folders the folder given is.

Use for retrive the folder Result.

Parameters

folder	the folder we are looking for.

Returns

the path find. Exemple of result "./../../Result/"

4.4.1.34 set_heatmap_grid()

```
def EER.function.set_heatmap_grid (
              nb_images,
              plot )
```

set_heatmap_grid function, set the grid in the heatmap to separate same user and different user in the heatmap.

Use for database with 8 image per user. Have to be modified for change that.

Parameters

nb_images	the number of image in the database.
plot	the plot of the heatmap.

4.4.1.35 show_EER()

```
def EER.function.show_EER (
              frr,
              far,
              max_threshold,
              title,
              eer,
              threshold )
```

show_EER function, make a graph of the FAR, FRR, EER and threshold optimum for the authentification.

Show the graph and save it too in the folder of the main file who execute this function.

Parameters

frr	the percent of reject for all threshold with couple with the same user
far	the percent of authentification for all threshold with couple with diffferent user
max_threshold	the number of threshold use for calculate far and frr. Not necessary gonna be delete in the future.
title	the title of the graph and the file.
eer	the value of the EER.
threshold	the value use by the system to accept authentification.

Returns

nothing.

4.4.1.36 show_image()

```
def EER.function.show_image (
              image )
```

show_image function, show the image given.

This function has to be change the color of the image aren't good, this function still functional.

Parameters

image	the image to be show.

Returns

nothing.

4.4.1.37 show_line()

```
def EER.function.show_line (
              line,
              name )
```

show_line function, show the graph of a line with sorted value.

Parameters

line	the list of value to put in the graph.
name	the name of the line in the graph.

Returns

nothing.

4.4.1.38 show_plot()

```
def EER.function.show_plot (
              lines_tab,
              names_tab,
              title,
              xlabel,
              ylabel,
              abscisse = -1 )
```

show_plot function, make show and save the plot create with all the curves given.

Parameters

lines_tab	list of all curves to be add in the plot. A curves is a list of data.
names_tab	list of name for all curves.
title	the title of the plot.
xlabel	the xlabel of the plot.
ylabel	the ylabel of the plot.
abscisse	the list of value use in abscisse. Default value -1 set the abscisse to the number between 1 and the number of data in the curve.

4.4.1.39 sobel_filter_no_class()

```
def EER.function.sobel_filter_no_class (
              im )
```

sobel_filter_no_class function, make the sobel filter on the image to make a vector of feature.

Parameters

im	the image.

Returns

the vector of feature calculate.

4.4.1.40 template_no_class()

```
def EER.function.template_no_class (
              im,
              M )
```

template_no_class function, calculate the template with the image and the matrix of projection.

Parameters

im	the image.
M	the matrix of projection.

Returns

the template calculate.

4.4.1.41 variation_image()

```
def EER.function.variation_image (
              attacker,
              delta )
```

variation_image function, make a variation in all pixel of the image.

Use for some test in genese in genetic algorithm. Not usefull.

Parameters

attacker	Image object of attacker.
delta	the gap value max accepted.

Returns

the image create.

4.4.1.42 write()

```
def EER.function.write (
              tab,
              new_folder,
              attacker = None,
              target = None,
              name = "",
              extention = ".csv",
              number_file = -1 )
```

write function, use for save data, image or graph depending of the extention in the parameter.

Parameters

tab	the data, image or graph to save.
new_folder	list of folder to save the contained.
attacker	Image object of the attacker. Default as None.
target	Image object of the target. Default as None.
name	of the file after the number suffix. Default value "".
extention	the extention of the file create define also the type of file. Default value ".csv"
number_file	the number use in suffix to the name file. If it is at -1 search a number avaible. Default value -1

Returns

the data, image of graph save.

4.5 EER.image Namespace Reference

Classes

- class Image

  Class Image.

Functions

- def copy (image)

  copy function, make a copy of a Image object.
- def create_all_images (path, size_template, size_line=-1, size_column=-1)

  create_all_images function, retrieve all digital footprint and create a list of Image object associate.
- def create_image (path, image_name, size_template, size_line=-1, size_column=-1)

  create_image function, retrieve the digital footprint and create the Image object associate.

4.5.1 Function Documentation

4.5.1.1 copy()

```
def EER.image.copy (
              image )
```

copy function, make a copy of a Image object.

Parameters

image	the Image object that we want copy.

Returns

the copy of the Image object.

4.5.1.2 create_all_images()

```
def EER.image.create_all_images (
              path,
              size_template,
              size_line = -1,
              size_column = -1 )
```

create_all_images function, retrieve all digital footprint and create a list of Image object associate.

Parameters

path	the path to find the digital footprint. Exemple : '../../BDD/image/DB1_B/'
size_template	the path to find the digital footprint.
size_line	the number of line in the wanted image. Default value -1, we take all the line of the entire image.
size_column	the number of column in the wanted image. Default value -1, we take all the column of the entire image.

Returns

the list of Image object create.

4.5.1.3 create_image()

```
def EER.image.create_image (
                path,
                image_name,
                size_template,
                size_line = -1,
                size_column = -1 )
```

create_image function, retrieve the digital footprint and create the Image object associate.

Parameters

path	the path to find the digital footprint.
image_name	the path to find the digital footprint.
size_template	the path to find the digital footprint.
size_line	the number of line in the wanted image. Default value -1, we take all the line of the entire image.
size_column	the number of column in the wanted image. Default value -1, we take all the column of the entire image.

Returns

the Image object create.

4.6 EER.setting Namespace Reference

Variables

- bool change1 = True

Boolean value.

- int delta = 10

  The maximum value accepted for the new value of the pixel in the change_pixel of the gradiant algorithm.
- int max_while = 4

  The number of iteration whiout any improve in genetic algorithm accepted before stop the execution.
- int number_file = -1

  The number use in suffixe of the different file name.
- int number_select = 12

  The number of person selected in the genetic algorithm.
- string path = '../../BDD/image/DB1_B/'

  path to retrive the database of the digital print.
- float proba_mutation = 0.03

  The probability of a pixel mutate with a new value.
- bool random_genese = False

  Boolean value.
- string selected_seed = "doferreira1"

  The seed selected to keep the repeatability of the algorithm.
- int size_image = 10

  The size of the image use.
- int size_template = 256

  The size of the template use.
- dictionary switch_folder

  Dictionary use to retrieve the string for create a folder to save data depending on the extention of file use.
- int threshold_evaluation = 0

  Threshold use in the evaluation.
- int time_gurobi = 10

  The limit of time in the resolution of the quadratic model with gurobi in seconds.
- bool want_write_image = False

  Boolean value.
- float weightI = 0.1

  Weight of the image in the objective function.

4.6.1 Detailed Description

File setting Contain the import and the global variable of all the project.

4.6.2 Variable Documentation

4.6.2.1 change1

```
bool EER.setting.change1 = True
```

Boolean value.

If true the gradiant algorithm gonna use the function change_pixel else use the function change_pixel2.

4.6.2.2 delta

```
int EER.setting.delta = 10
```

The maximum value accepted for the new value of the pixel in the change_pixel of the gradiant algorithm.

Value in [1,255].

4.6.2.3 max_while

```
int EER.setting.max_while = 4
```

The number of iteration whiout any improve in genetic algorithm accepted before stop the execution.

Value in [1,].

4.6.2.4 number_file

```
int EER.setting.number_file = -1
```

The number use in suffixe of the different file name.

If the value is -1 the function write gonna take a number avaible to keep all the existant files. The fucntion multiple optimisation gonne retrieve the data file if it exist if this parameter is different than 1. So if you want create new file of data you have to take a new suffix never use or -1 but -1 is inapporpiate for save data files we can't retrieve the file after that.

4.6.2.5 number_select

```
int EER.setting.number_select = 12
```

The number of person selected in the genetic algorithm.

Value in [1,].

4.6.2.6 path

```
string EER.setting.path = '../../BDD/image/DB1_B/'
```

path to retrive the database of the digital print.

path = '../../BDD/image/bmp/'

4.6.2.7 proba_mutation

```
float EER.setting.proba_mutation = 0.03
```

The probability of a pixel mutate with a new value.

Value in [0,1].

4.6.2.8 random_genese

```
bool EER.setting.random_genese = False
```

Boolean value.

If true the image in genese of the genetic algorithm gonna be random, else it's a copy of the attacker image.

4.6.2.9 selected_seed

```
string EER.setting.selected_seed = "doferreira1"
```

The seed selected to keep the repeatability of the algorithm.

4.6.2.10 size_image

```
int EER.setting.size_image = 10
```

The size of the image use.

If value is -1 the image is complete else the image is the middle of the original digital print with a size depending on this value.

4.6.2.11 size_template

```
int EER.setting.size_template = 256
```

The size of the template use.

Value in [1,].

4.6.2.12 switch_folder

```
dictionary EER.setting.switch_folder
```

Initial value:

```
=  {".csv" : ["data"],
".bmp" : ["image"],
".png" : ["plot"]}
```

Dictionary use to retrieve the string for create a folder to save data depending on the extention of file use.

Use in write function.

4.6.2.13 threshold_evaluation

```
int EER.setting.threshold_evaluation = 0
```

Threshold use in the evaluation.

When the distance template is smaller than threshold the objective value gonne take a distance template at 0. Value in [0,1].

4.6.2.14 time_gurobi

```
int EER.setting.time_gurobi = 10
```

The limit of time in the resolution of the quadratic model with gurobi in seconds.

4.6.2.15 want_write_image

```
bool EER.setting.want_write_image = False
```

Boolean value.

If true the image gonna be save in a folder.

4.6.2.16 weightI

```
float EER.setting.weightI = 0.1
```

Weight of the image in the objective function.

Value in [0,1]

4.7 main Namespace Reference

Variables

- string path = '../../BDD/image/DB1_B/'

  path to retrive the database of the digital print.
- int size_image = 5

  The size of the image use.
- int size_template = 64

  The size of the template use.
- start = time()

4.7.1 Detailed Description

File main Use for make the call of attack by quadratic solver with Gurobi.

4.7.2 Variable Documentation

4.7.2.1 path

```
string main.path = '../../BDD/image/DB1_B/'
```

path to retrive the database of the digital print.

4.7.2.2 size_image

```
int main.size_image = 5
```

The size of the image use.

If value is -1 the image is complete else the image is the middle of the original digital print with a size depending on this value.

4.7.2.3 size_template

```
int main.size_template = 64
```

The size of the template use.

Value in [1,].

4.7.2.4 start

```
main.start = time()
```

4.8 modele_321 Namespace Reference

Functions

- def make_folder (attacker, target=None)

  make_folder function, make a list of folders for save data with write function.
- def modele321 (attacker, target)

  modele321 function, construct the linear problem in 3.2.1 of the article Authentication Attacks on Projection-based Cancelable Biometric Schemes DURBET Axel, GROLLEMUND Paul-Marie, LAFOURCADE Pascal, MIGDAL Denis and THIRY-ATIGHEHCHI and return the new feature calculate
- def multiple_attack_321 (images)

  multiple_attack_321 function, make the part 1 of the quadratic model attack for all couple with a different user.
- def multiple_autenticate_321 (images)

  multiple_autenticate_321 function, make the part 1 of the quadratic model attack for all couple with the same user.
- def test_321 (attacker, target)

  test_321 function, execute the linear part of the quadratic model.

4.8.1 Detailed Description

File modele_321 Contain the first part of the attack by quadratic model with Gurobi.

4.8.2 Function Documentation

4.8.2.1 make_folder()

```
def modele_321.make_folder (
              attacker,
              target = None )
```

make_folder function, make a list of folders for save data with write function.

Folder is /modele_321/bdd_∗∗∗/template_∗∗∗/image_∗∗∗x∗∗∗/.

Parameters

attacker	Image object of the attacker.
target	Image object of the target. Default None. If target is not as None add the folder /attack_∗∗∗->∗∗∗/

Returns

the list of folder. The list is ["modele_321","bdd_∗∗∗","template_∗∗∗", "image_∗∗∗x∗∗∗"] for exemple.

4.8.2.2 modele321()

```
def modele_321.modele321 (
              attacker,
              target )
```

modele321 function, construct the linear problem in 3.2.1 of the article Authentication Attacks on Projection-based Cancelable Biometric Schemes DURBET Axel, GROLLEMUND Paul-Marie, LAFOURCADE Pascal, MIGDAL Denis and THIRY-ATIGHEHCHI and return the new feature calculate

Parameters

attacker	Image object of attacker.
target	Image object of target.

Returns

the new feature find with the model or -1 if the model is infeasable.

4.8.2.3 multiple_attack_321()

```
def modele_321.multiple_attack_321 (
              images )
```

multiple_attack_321 function, make the part 1 of the quadratic model attack for all couple with a different user.

Parameters

images	list of Image object. Normally use all the image of the database.

Returns

the list of distance template calculate with the new feature find.

4.8.2.4 multiple_autenticate_321()

```
def modele_321.multiple_autenticate_321 (
              images )
```

multiple_autenticate_321 function, make the part 1 of the quadratic model attack for all couple with the same user.

Parameters

images	list of Image object. Normally use all the image of the database.

Returns

the list of distance template calculate with the new feature find.

4.8.2.5 test_321()

```
def modele_321.test_321 (
              attacker,
              target )
```

test_321 function, execute the linear part of the quadratic model.

Parameters

attacker	Image object of attacker.
target	Image object of target.

Returns

the distance between the target template and the template create with the new feature calculate with the model.

4.9 modele_322 Namespace Reference

Functions

- def all_322 (images, objective=False)

  all_322 function, make the quadratic model attack for all couple.
- def make_folder (attacker, target=None)

  make_folder function, make a list of folders for save data with write function.
- def max_filtered_value_model ()

  max_filtered_value_model function to find the born value of max_filtered_value for the quadratic model.
- def modele322 (image, FA, objective=False)

  modele322 function, construct the quadratic problem in 3.2.2 of the article Authentication Attacks on Projection-based Cancelable Biometric Schemes DURBET Axel, GROLLEMUND Paul-Marie, LAFOURCADE Pascal, MIGDAL Denis and THIRY-ATIGHEHCHI and return the new image calculate
- def multiple_autenticate_322 (images, objective)

  multiple_autenticate_322 function, make the quadratic model attack for all couple with the same user.
- def test_322 (attacker, target, objective=False)

  test_322 function, execute the quadratic model.

4.9.1 Function Documentation

4.9.1.1 all_322()

```
def modele_322.all_322 (
              images,
              objective = False )
```

all_322 function, make the quadratic model attack for all couple.

Parameters

images	list Image object. Normally use all the image of the database.
objective	Boolean. Default False, if True the quadratic model add the objective function at the model.

Returns

the list of distance template calculate with the new image find and create heatmap of time_execution, distance template and distance image.

4.9.1.2 make_folder()

```
def modele_322.make_folder (
              attacker,
              target = None )
```

make_folder function, make a list of folders for save data with write function.

Folder is /modele_322/bdd_∗∗∗/template_∗∗∗/image_∗∗∗x∗∗∗/.

Parameters

attacker	Image object of the attacker.
target	Image object of the target. Default None. If target is not as None add the folder /attack_∗∗∗->∗∗∗/

Returns

the list of folder. The list is ["modele_322","bdd_∗∗∗","template_∗∗∗", "image_∗∗∗x∗∗∗"] for exemple.

4.9.1.3 max_filtered_value_model()

```
def modele_322.max_filtered_value_model ( )
```

max_filtered_value_model function to find the born value of max_filtered_value for the quadratic model.

4.9.1.4 modele322()

```
def modele_322.modele322 (
              image,
              FA,
              objective = False )
```

modele322 function, construct the quadratic problem in 3.2.2 of the article Authentication Attacks on Projection-based Cancelable Biometric Schemes DURBET Axel, GROLLEMUND Paul-Marie, LAFOURCADE Pascal, MIGDAL Denis and THIRY-ATIGHEHCHI and return the new image calculate

Parameters

attacker	Image object of attacker.
target	Image object of target.
objective	Boolean. Default False, if True the quadratic model add the objective function at the model.

Returns

a list with [code, time_execution, objective_value, the image find]. code is 1 if optimal find, -2 if infeasable or -3 if the the model is out of time.

4.9.1.5 multiple_autenticate_322()

```
def modele_322.multiple_autenticate_322 (
              images,
              objective )
```

multiple_autenticate_322 function, make the quadratic model attack for all couple with the same user.

Parameters

images	list Image object. Normally use all the image of the database.
objective	Boolean. Default False, if True the quadratic model add the objective function at the model.

Returns

the list of distance template calculate with the new image find.

4.9.1.6 test_322()

```
def modele_322.test_322 (
              attacker,
              target,
              objective = False )
```

test_322 function, execute the quadratic model.

Parameters

attacker	Image object of attacker.
target	Image object of target.
objective	Boolean. Default False, if True the quadratic model add the objective function at the model.

Returns

the distance between the target template and the template create with the new feature calculate with the model.

Chapter 5

Class Documentation

5.1 EER.image.Image Class Reference

Class Image.

Public Member Functions

- def __init__ (self, image, size_template, bdd, name_image)

  The constructor of the class Image.
- def binarisation (self, R)

  Method for Image class.
- def change_feature (self, feature)

  Method for Image class.
- def change_image (self, image)

  Method for Image class.
- def change_matrix (self, matrix)

  Method for Image class.
- def find_template (self)

  Method for Image class.
- def projection (self, F=None)

  Method for Image class.
- def retrieve_matrix (self)

  Method for Image class.
- def sobel_filter (self)

  Method for Image class.

Public Attributes

- bdd

  The string of the folder of the database use.
- feature

  The vector of feature of the image.
- image

  Two dimension list with value in [0,255] for the value of the pixel.

- m

  Width of the image.
- matrix

  The matrix of projection of the user.
- n

  Length of the image.
- name_image

  The name of the file of the digital print.
- size_template

  The size of the template use.
- template

  The vector of template of the image.
- user

  The number of the user of the digital print.

5.1.1 Detailed Description

Class Image.

Contains attributes and methods needed by different attacks to manipulate images.

5.1.2 Constructor & Destructor Documentation

5.1.2.1 __init__()

```
def EER.image.Image.__init__ (
              self,
              image,
              size_template,
              bdd,
              name_image )
```

The constructor of the class Image.

Parameters

image	the image of digital print.
size_template	the size of the template. Value in [1,].
bdd	the string of the folder of the database use.
name_image	the name of the file of the digital print.

5.1.3 Member Function Documentation

5.1.3.1 binarisation()

```
def EER.image.Image.binarisation (
              self,
              R )
```

Method for Image class.

binarisation function, calculate the binarisation of the object. Set the template obtain in the object.

Parameters

R	the result of the matrix product.

Returns

the template obtain.

5.1.3.2 change_feature()

```
def EER.image.Image.change_feature (
              self,
              feature )
```

Method for Image class.

change_feature function, change the feature and calculate the new template associate.

Parameters

feature	the new feature.

5.1.3.3 change_image()

```
def EER.image.Image.change_image (
              self,
              image )
```

Method for Image class.

change_image function, change the image of digital print and calculate the new feature and template associate.

Parameters

image	the image of the new digital print.

5.1.3.4 change_matrix()

```
def EER.image.Image.change_matrix (
              self,
              matrix )
```

Method for Image class.

change_matrix function, change the matrix and calculate the new template associate.

Parameters

matrix	the new matrix.

5.1.3.5 find_template()

```
def EER.image.Image.find_template (
              self )
```

Method for Image class.

find_template function, calculate the template of the object.

5.1.3.6 projection()

```
def EER.image.Image.projection (
              self,
              F = None )
```

Method for Image class.

projection function, calculate the matrix product of the object.

Parameters

F	the feature of the object. Default value None. Depreciate not use anymore.

Returns

the result obtain.

5.1.3.7 retrieve_matrix()

```
def EER.image.Image.retrieve_matrix (
              self )
```

Method for Image class.

retrieve_matrix function, retrive the matrix of a user with a seed obtain with the user, the database, the size of template and the size of digital print use. Set the matrix obtain in the object.

5.1.3.8 sobel_filter()

```
def EER.image.Image.sobel_filter (
              self )
```

Method for Image class.

sobel_filter function, calculate the sobel_filter of the object. Set the feature obtain in the object.

5.1.4 Member Data Documentation

5.1.4.1 bdd

```
EER.image.Image.bdd
```

The string of the folder of the database use.

5.1.4.2 feature

```
EER.image.Image.feature
```

The vector of feature of the image.

5.1.4.3 image

```
EER.image.Image.image
```

Two dimension list with value in [0,255] for the value of the pixel.

This is the image of the attacker in the attack.

5.1.4.4 m

```
EER.image.Image.m
```

Width of the image.

5.1.4.5 matrix

```
EER.image.Image.matrix
```

The matrix of projection of the user.

5.1.4.6 n

```
EER.image.Image.n
```

Length of the image.

5.1.4.7 name_image

```
EER.image.Image.name_image
```

The name of the file of the digital print.

5.1.4.8 size_template

```
EER.image.Image.size_template
```

The size of the template use.

Value in [1,].

5.1.4.9 template

```
EER.image.Image.template
```

The vector of template of the image.

It's use to autenticate the user.

5.1.4.10 user

```
EER.image.Image.user
```

The number of the user of the digital print.

The documentation for this class was generated from the following file:

- EER/image.py

5.2 EER.function.Person Class Reference

Class Person.

Public Member Functions

- def __init__ (self, image, matrix, old_image, weightI, target_template, distance_template=1, distance_image=1)

  The constructor of the class Person.
- def evaluation (self, weightI, threshold)

  Method for Person class.
- def set_distance (self, distance_template, distance_image, weightI, threshold)

  Method for Person class.

Public Attributes

- distance_image

  The distance between the original image of the attacker and the modified image.
- distance_template

  The distance between the target_template and the new template of the attacker calculate with the new image.
- image

  Two dimension list with value in [0,255] for the value of the pixel.
- matrix

  Two dimension list with value in [-0.5,0.5].
- objective

  Value objective of the image calculate with the distance_image and the distance_template depending on the parameter weightI.
- old_image

  Two dimension list with value in [0,255] for the value of the pixel.
- target_template

  One dimension list with value in {0,1}.

5.2.1 Detailed Description

Class Person.

Contains attributes and methods needed by different attacks to keep all the necessaries data. The name of the class as to be changed. It was create with the genetic algorithm but now the name is outdated.

5.2.2 Constructor & Destructor Documentation

5.2.2.1 __init__()

```
def EER.function.Person.__init__ (
              self,
              image,
              matrix,
              old_image,
              weightI,
              target_template,
              distance_template = 1,
              distance_image = 1 )
```

The constructor of the class Person.

Parameters

image	the image of digital print. it is the image that will be modifies in the attack.
matrix	the matrix of the target in the attack.
old_image	the orginal image of the attacker before modification.
weightI	the weight of the image in the objective function.
target_template	the template of the target.
distance_template	the distance template in the objective function. Default value 1.
distance_image	the distance image in the objective. Default value 1.

5.2.3 Member Function Documentation

5.2.3.1 evaluation()

```
def EER.function.Person.evaluation (
              self,
              weightI,
              threshold )
```

Method for Person class.

evaluation function, calculate the objective value of attacker. Set the value in attacker.objective.

Parameters

weightI	the weight of the image in the objective function. Take real value between 0 and 1.
threshold	the threshold use by the system to accept authentification. Take real value between 0 and 1.

Returns

the value objective of the attacker

5.2.3.2 set_distance()

```
def EER.function.Person.set_distance (
              self,
              distance_template,
              distance_image,
              weightI,
              threshold )
```

Method for Person class.

set_distance function, calculate the objective value with the two distance required and set the value obtain. If distance_template < threshold distance_template is considered to be at 0 for the objective value to stop degraded the image when the authentification is successful.

Parameters

distance_template	the distance template in the objective function.
distance_image	the distance image in the objective.
weightI	the weight of the image in the objective function. Take real value between 0 and 1.
threshold	the threshold use by the system to accept authentification.

5.2.4 Member Data Documentation

5.2.4.1 distance_image

```
EER.function.Person.distance_image
```

The distance between the original image of the attacker and the modified image.

Value in [0,1].

5.2.4.2 distance_template

```
EER.function.Person.distance_template
```

The distance between the target_template and the new template of the attacker calculate with the new image.

Value in [0,1].

5.2.4.3 image

```
EER.function.Person.image
```

Two dimension list with value in [0,255] for the value of the pixel.

This is the modified image of the attacker in the attack.

5.2.4.4 matrix

```
EER.function.Person.matrix
```

Two dimension list with value in [-0.5,0.5].

This is the matrix of the target in the attack.

5.2.4.5 objective

```
EER.function.Person.objective
```

Value objective of the image calculate with the distance_image and the distance_template depending on the parameter weightI.

Value in [0,1].

5.2.4.6 old_image

```
EER.function.Person.old_image
```

Two dimension list with value in [0,255] for the value of the pixel.

This is the original image of the attacker before the attack.

5.2.4.7 target_template

```
EER.function.Person.target_template
```

One dimension list with value in {0,1}.

This is the template of the target in tha attack.

The documentation for this class was generated from the following file:

- EER/function.py

Chapter 6

File Documentation

6.1 Attack/main.py File Reference

Namespaces

- main

Variables

- string main.path = '../../BDD/image/DB1_B/'

  path to retrive the database of the digital print.
- int main.size_image = 5

  The size of the image use.
- int main.size_template = 64

  The size of the template use.
- main.start = time()

6.2 Attack/modele_321.py File Reference

Namespaces

- modele_321

Functions

- def modele_321.make_folder (attacker, target=None)

  make_folder function, make a list of folders for save data with write function.
- def modele_321.modele321 (attacker, target)

  modele321 function, construct the linear problem in 3.2.1 of the article Authentication Attacks on Projection-based Cancelable Biometric Schemes DURBET Axel, GROLLEMUND Paul-Marie, LAFOURCADE Pascal, MIGDAL Denis and THIRY-ATIGHEHCHI and return the new feature calculate
- def modele_321.multiple_attack_321 (images)

  multiple_attack_321 function, make the part 1 of the quadratic model attack for all couple with a different user.
- def modele_321.multiple_autenticate_321 (images)

  multiple_autenticate_321 function, make the part 1 of the quadratic model attack for all couple with the same user.
- def modele_321.test_321 (attacker, target)

  test_321 function, execute the linear part of the quadratic model.

6.3 Attack/modele_322.py File Reference

Namespaces

- modele_322

Functions

- def modele_322.all_322 (images, objective=False)

  all_322 function, make the quadratic model attack for all couple.
- def modele_322.make_folder (attacker, target=None)

  make_folder function, make a list of folders for save data with write function.
- def modele_322.max_filtered_value_model ()

  max_filtered_value_model function to find the born value of max_filtered_value for the quadratic model.
- def modele_322.modele322 (image, FA, objective=False)

  modele322 function, construct the quadratic problem in 3.2.2 of the article Authentication Attacks on Projection-based Cancelable Biometric Schemes DURBET Axel, GROLLEMUND Paul-Marie, LAFOURCADE Pascal, MIGDAL Denis and THIRY-ATIGHEHCHI and return the new image calculate
- def modele_322.multiple_autenticate_322 (images, objective)

  multiple_autenticate_322 function, make the quadratic model attack for all couple with the same user.
- def modele_322.test_322 (attacker, target, objective=False)

  test_322 function, execute the quadratic model.

6.4 EER/__init__.py File Reference

Namespaces

- EER

6.5 EER/EER.py File Reference

Namespaces

- EER.EER

Functions

- def EER.EER.EER (FRR, FAR, number_threshold, images)

  EER function, calculate the EER and the threshold with the FAR and FRR gives and show the graph.
- def EER.EER.EER_file (file_FRR, file_FAR, number_threshold)

  EER_file function, call EER function with the data in the files gives in parameter.
- def EER.EER.EER_start (images, number_threshold)

  EER_start function, call FRR, FAR and EER function.
- def EER.EER.FAR (images)

  FAR function, calculate all the distance template for all couple of image with a different user.
- def EER.EER.FRR (images)

  FRR function, calculate all the distance template for all couple of image with the same user.
- def EER.EER.make_folder (attacker, last_folder)

  make_folder function, make a list of folders for save data with write function.

Variables

- EER.EER.images = create_all_images(path, size_template, size_image, size_image)
- int EER.EER.number_threshold = 1000
- string EER.EER.path = '../BDD/image/DB1_B/'
- int EER.EER.size_image = -1
- int EER.EER.size_template = 64
- EER.EER.start = time()

6.6 EER/filter_EER.py File Reference

Namespaces

- EER.filter_EER

Functions

- def EER.filter_EER.EER (FRR, FAR, max_threshold)
- def EER.filter_EER.EER_file (file_FRR, file_FAR, max_threshold)
- def EER.filter_EER.EER_start (images, max_threshold)
- def EER.filter_EER.FAR (images)
- def EER.filter_EER.FRR (images)
- def EER.filter_EER.make_folder (attacker, last_folder)

Variables

- string EER.filter_EER.BDD = path.split("/")[-2]
- string EER.filter_EER.file = "0_test.csv"
- list EER.filter_EER.first_256 = [51.749,43.346,41.94,38.866,39.163]
- list EER.filter_EER.full_256 = [51.177,48.157,55.698,15.031,44.877]
- list EER.filter_EER.images = [0]∗80
- EER.filter_EER.images_bdd = create_all_images(path, 64, 10, 10)
- int EER.filter_EER.max_threshold = 1000
- EER.filter_EER.number = split('_| ', file)
- string EER.filter_EER.path = '../BDD/image/DB1_B/'
- list EER.filter_EER.second_256 = [51.732,50.793,46.36,36.583,37.551]
- int EER.filter_EER.size_image = -1
- int EER.filter_EER.size_template = 256
- EER.filter_EER.start = time()

6.7 EER/function.py File Reference

Classes

- class EER.function.Person

  Class Person.

Namespaces

- EER.function

Functions

- def EER.function.add_plot (lines_tab, names_tab, ax, i, j, ylabel, abscisse=-1)

  add_plot function, add plot in the subplot given.
- def EER.function.all_images (path)

  all_images function, create a list with all images find in a folder.
- def EER.function.all_images_name (path)

  all_images_name function, create a list with all names files in a folder.
- def EER.function.binarisation_no_class (R)

  binarisation_no_class function, calculate the template with the result obtain after projection.
- def EER.function.blurry_image (attacker)

  blurry_image function, make a mean of the four pixel around each pixel to make a new value.
- def EER.function.calcul_EER_lines (FRR, FAR, max_threshold)

  calcul_EER_lines function, with value of distance obtain in FAR and FRR calculate the far and frr percent authentication.
- def EER.function.copy_home (tab)

  copy_home function, copy_home make a copy of a two dimension list.
- def EER.function.create_file_data_name (name_algorithm, number_file, parameter, add_number_file=False, add_extension=False)

  create_file_data_name function, create a name file for save data of multiple attack by algorithm gives in name_↩ algorithm parameter.
- def EER.function.create_file_data_name_list (name_algorithm, number, parameter_list)

  create_file_data_name_list function, create a list of name file for load data of multiple attack by genetic algorithm.
- def EER.function.create_file_image_name (weightI, start_distance_template, person)

  create_file_image_name function, create a name file for save image.
- def EER.function.create_parameter_list (tab, index, constant_parameter_list)

  create_parameter_list function, create a list of parameter_list to be used in graph_multiple_parameter_file function.
- def EER.function.create_path (root, new_folders)

  create_path function, create a path with the root and the list of folders given and create the folder if isn't exist.
- def EER.function.distance_feature_norm (F1, F2, width)

  distance_feature_norm function, calculate the distance normalize between two feature.
- def EER.function.distance_image_norm (I1, I2)

  distance_image_norm function, calculate the distance normalize between two image.
- def EER.function.distance_template_norm (T1, T2)

  distance_template_norm function, calculate the distance normalize between two template.
- def EER.function.exchange (list, i, j)

  exchange function, exchange two value in a list.
- def EER.function.find_nb_file (path, name_file)

  find_nb_file function, find the number of file with the same name without the number in suffix.
- def EER.function.find_nb_file_avaible (path, name_file)

  find_nb_file_avaible function, find a number suffix not use in the folder for the name file given.
- def EER.function.graph_multiple_parameter (folder, start_distance, tab_parameter, min_mean_max, time, xlabel, name, number_file=-1, quantile=0)

  graph_multiple_parameter function, use for make and save graph with data of result obtain with different parameter.
- def EER.function.graph_multiple_parameter_file (folder, start_distance, tab_parameter, number, parameter↩ _list, xlabel, name, line_solution=0, quantile=0)

  graph_multiple_parameter_file function, retrieve name file and data for use graph_multiple_parameter function.

- def EER.function.heatmap_distance (distance_couple, images, threshold=-1, subtitle="")

  heatmap_distance function, make show and save the heatmap of the distance given.
- def EER.function.heatmap_time_execution (time_couple, images, time_limit, subtitle="")

  heatmap_time_execution function, make the heatmap of the time of execution.
- def EER.function.make_subplot (lines_tab, names_tab, main_title, title_plot, xlabel, ylabel, abscisse=-1, ylim=-1)

  make_subplot function, make, show and save a subplot 2 by 2 with curves store in a list.
- def EER.function.print_EER (index, max_threshold, frr, far)

  print_EER function, Print the value of false reject, false acceptance, distance and the mean between the far and frr for the threshold chosen and one before and after.
- def EER.function.print_tab (tab)

  print_tab function, print each row of a list.
- def EER.function.projection_no_class (F, M)

  projection_no_class function, make the projection with the vector of feature and the matrix of the user.
- def EER.function.random_image (n, m)

  random_image function, create a random image with value between 0 and 255.
- def EER.function.retrieve_first_row_from_file (file)

  retrieve_first_row_from_file function, return the first row of the file given.
- def EER.function.retrieve_tab_from_file (file)

  retrieve_tab_from_file function, return all the row of the file given in a list.
- def EER.function.retrive_user (name_image)

  retrive_user function, retrieve the user number with the name of the file.
- def EER.function.save_image_attacker_and_target (path, attacker, target)

  save_image_attacker_and_target function, save the original digital print of the attacker and the target in the folder.
- def EER.function.save_plot (tab, file)

  save_plot function, save a graph in a name file given with the data store in a list.
- def EER.function.search_folder (folder)

  search_folder function, retrieve in which parents folders the folder given is.
- def EER.function.set_heatmap_grid (nb_images, plot)

  set_heatmap_grid function, set the grid in the heatmap to separate same user and different user in the heatmap.
- def EER.function.show_EER (frr, far, max_threshold, title, eer, threshold)

  show_EER function, make a graph of the FAR, FRR, EER and threshold optimum for the authentification.
- def EER.function.show_image (image)

  show_image function, show the image given.
- def EER.function.show_line (line, name)

  show_line function, show the graph of a line with sorted value.
- def EER.function.show_plot (lines_tab, names_tab, title, xlabel, ylabel, abscisse=-1)

  show_plot function, make show and save the plot create with all the curves given.
- def EER.function.sobel_filter_no_class (im)

  sobel_filter_no_class function, make the sobel filter on the image to make a vector of feature.
- def EER.function.template_no_class (im, M)

  template_no_class function, calculate the template with the image and the matrix of projection.
- def EER.function.variation_image (attacker, delta)

  variation_image function, make a variation in all pixel of the image.
- def EER.function.write (tab, new_folder, attacker=None, target=None, name="", extention=".csv", number_↩ file=-1)

  write function, use for save data, image or graph depending of the extention in the parameter.

6.8 EER/image.py File Reference

Classes

- class EER.image.Image

  Class Image.

Namespaces

- EER.image

Functions

- def EER.image.copy (image)

  copy function, make a copy of a Image object.
- def EER.image.create_all_images (path, size_template, size_line=-1, size_column=-1)

  create_all_images function, retrieve all digital footprint and create a list of Image object associate.
- def EER.image.create_image (path, image_name, size_template, size_line=-1, size_column=-1)

  create_image function, retrieve the digital footprint and create the Image object associate.

6.9 EER/setting.py File Reference

Namespaces

- EER.setting

Variables

- bool EER.setting.change1 = True

  Boolean value.
- int EER.setting.delta = 10

  The maximum value accepted for the new value of the pixel in the change_pixel of the gradiant algorithm.
- int EER.setting.max_while = 4

  The number of iteration whiout any improve in genetic algorithm accepted before stop the execution.
- int EER.setting.number_file = -1

  The number use in suffixe of the different file name.
- int EER.setting.number_select = 12

  The number of person selected in the genetic algorithm.
- string EER.setting.path = '../../BDD/image/DB1_B/'

  path to retrive the database of the digital print.
- float EER.setting.proba_mutation = 0.03

  The probability of a pixel mutate with a new value.
- bool EER.setting.random_genese = False

  Boolean value.
- string EER.setting.selected_seed = "doferreira1"

  The seed selected to keep the repeatability of the algorithm.
- int EER.setting.size_image = 10

The size of the image use.

- int EER.setting.size_template = 256

  The size of the template use.
- dictionary EER.setting.switch_folder

  Dictionary use to retrieve the string for create a folder to save data depending on the extention of file use.
- int EER.setting.threshold_evaluation = 0

  Threshold use in the evaluation.
- int EER.setting.time_gurobi = 10

  The limit of time in the resolution of the quadratic model with gurobi in seconds.
- bool EER.setting.want_write_image = False

  Boolean value.
- float EER.setting.weightI = 0.1

  Weight of the image in the objective function.