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LAMPIRAN

Lampiran 1 *Source code* model klasifikasi menggunakan SVM dengan pengelompokan *K-Means*

```
import os
import cv2
import itertools
import numpy as np
from sklearn.svm import SVC
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, confusion_matrix,
f1_score, classification_report
from sklearn.utils import shuffle


# Preparing the dataset
path = './data'
image_path = []
image_label = []
for sub_folder in os.listdir(os.path.join(path)):
    if sub_folder == '.DS_Store' or sub_folder ==
'.ipynb_checkpoints':
        continue
    sub_folder_files = os.listdir(os.path.join(path,
sub_folder))
    len_sub_folder = len(sub_folder_files) - 1
    for i, filename in enumerate(sub_folder_files):
        if filename == '.ipynb_checkpoints' or filename ==
'.DS_Store':
            continue
        image_path.append(os.path.join(path, sub_folder,
filename))
        image_label.append(sub_folder)


# Split data to train and test
image_path_train, image_path_test =
train_test_split(image_path, test_size=0.2, random_state=19,
stratify=image_label)


# Function for Feature Extraction
def CalcFeatures(img, th):
    sift = cv2.SIFT_create(th)
    kp, des = sift.detectAndCompute(img, None)
    return des

def getSIFTFeature(thresh, path):
```

```
    features = []
    for file in path:
        img = cv2.imread(file, 0)
        img_des = CalcFeatures(img, thresh)
        if img_des is not None:
            features.append(img_des)
    features = np.vstack(features)
    return features

def bag_of_features(features, centres, k = 500):
    vec = np.zeros((1, k))
    for i in range(features.shape[0]):
        feat = features[i]
        diff = np.tile(feat, (k, 1)) - centres
        dist = pow(((pow(diff, 2)).sum(axis = 1)), 0.5)
        idx_dist = dist.argsort()
        idx = idx_dist[0]
        vec[0][idx] += 1
    return vec


# RBF SVM function
class RBFKernelSVM:
    def __init__(self, kernel='rbf', gamma=None, C=1):
        self.kernel = kernel
        self.gamma = gamma
        self.C = C

    def fit(self, X, y):
        n_samples, n_features = X.shape

        # Compute the kernel matrix
        if self.kernel == 'rbf':
            if self.gamma is None:
                self.gamma = 1 / n_features
            K = np.zeros((n_samples, n_samples))
            for i in range(n_samples):
                for j in range(n_samples):
                    K[i,j] = np.exp(-self.gamma *
np.linalg.norm(X[i]-X[j])**2)
        else:
            raise ValueError("Unsupported kernel function")

        # Solve the dual optimization problem using quadratic
programming
        P = np.outer(y, y) * K
        q = -np.ones(n_samples)
        G = np.vstack((-np.eye(n_samples), np.eye(n_samples)))
```

```
        h = np.hstack((np.zeros(n_samples), np.ones(n_samples)
* self.C))
        A = y.reshape(1, -1)
        A = A.astype('float')
        b = np.zeros(1)

        alpha = np.zeros(n_samples)
        from cvxopt import matrix, solvers
        solvers.options['show_progress'] = None
        sol = solvers.qp(matrix(P), matrix(q), matrix(G),
matrix(h), matrix(A), matrix(b))
        alpha = np.ravel(sol['x'])

        # Find the support vectors
        sv_indices = alpha > 1e-5
        self.support_vectors = X[sv_indices]
        self.support_vector_labels = y[sv_indices]
        self.support_vector_alpha = alpha[sv_indices]

        # Compute the bias term
        sv_index = np.argmax(self.support_vector_alpha)
        self.b = self.support_vector_labels[sv_index]
        for i in range(n_samples):
            if alpha[i] > 1e-5:
                self.b -= alpha[i] * y[i] * K[i,sv_index]
        self.b /= len(self.support_vector_alpha)

    def predict(self, X):
        if self.kernel == 'rbf':
            K = np.zeros((len(X), len(self.support_vectors)))
            for i in range(len(X)):
                for j in range(len(self.support_vectors)):
                    K[i,j] = np.exp(-self.gamma *
np.linalg.norm(X[i]-self.support_vectors[j])**2)
        else:
            raise ValueError("Unsupported kernel function")

        predictions = np.sign(np.dot(K,
self.support_vector_alpha * self.support_vector_labels) +
self.b)
        return predictions.astype(int)


# Linear SVM Function
def compute_cost(W, X, Y):
    # calculate hinge loss
    N = X.shape[0]
    distances = 1 - Y * (np.dot(X, W))
```

```
    distances[distances < 0] = 0  # equivalent to max(0,
distance)
    hinge_loss = reg_strength * (np.sum(distances) / N)

    # calculate cost
    cost = 1 / 2 * np.dot(W, W) + hinge_loss
    return cost

def calculate_cost_gradient(W, X_batch, Y_batch):
    # if only one example is passed (eg. in case of SGD)
    if type(Y_batch) == np.float64 or type(Y_batch) ==
np.int64:
        Y_batch = np.array([Y_batch])
        X_batch = np.array([X_batch])
    distance = 1 - (Y_batch * np.dot(X_batch, W))
    dw = np.zeros(len(W))
    for ind, d in enumerate(distance):
        if max(0, d) == 0:
            di = W
        else:
            di = W - (reg_strength * Y_batch[ind] *
X_batch[ind])
        dw += di
    dw = dw/len(Y_batch)  # average
    return dw

def sgd(features, outputs):
    max_epochs = 5000
    weights = np.zeros(features.shape[1])
    nth = 0
    prev_cost = float("inf")
    cost_threshold = 0.01  # in percent
    # stochastic gradient descent
    for epoch in range(1, max_epochs):
        # shuffle to prevent repeating update cycles
        X, Y = shuffle(features, outputs)
        for ind, x in enumerate(X):
            ascent = calculate_cost_gradient(weights, x,
Y[ind])
            weights = weights - (learning_rate * ascent)
        # convergence check on 2^nth epoch
        if epoch == 2 ** nth or epoch == max_epochs - 1:
            cost = compute_cost(weights, features, outputs)

            # stoppage criterion
            if abs(prev_cost - cost) < cost_threshold *
prev_cost:
                return weights
            prev_cost = cost
```

```
            nth += 1
    return weights

def SVMClassifier(X_train, y_train, reg_strength,
learning_rate):
    W = sgd(X_train, y_train)
    # print("weights are: {}".format(W))
    return W


# Training for Model "Bukan Alergi dan Jamur" vs "Alergi atau
Jamur"
thresh = [10, 15, 20, 25, 30, 40]
k_value = [0.05, 0.1, 0.2]
C = [0.001, 0.01, 0.1, 1, 10, 100, 1000]
gamma = [0.001, 0.01, 0.1, 1, 10, 100, 1000]

centers = {}
models = {}
features = {}

for th in thresh:
    centers[th] = {}
    models[th] = {}
    features[th] = getSIFTFeature(th, image_path_train)
    for k in k_value:
        k = int(k * th * len(image_path_train))

        criteria = (cv2.TERM_CRITERIA_EPS +
cv2.TERM_CRITERIA_MAX_ITER, 10, 0.1)
        flags = cv2.KMEANS_RANDOM_CENTERS
        compact, labels, centres = cv2.kmeans(features[th], k,
None, criteria, 10, flags)
        centers[th][k] = centres

        y_train = []
        vec = []
        for file in image_path_train:
            img = cv2.imread(file, 0)
            img_des = CalcFeatures(img, th)
            if img_des is not None:
                img_vec = bag_of_features(img_des, centres, k)
                vec.append(img_vec)
                if file.split('/')[2] == 'bukan_alergi_jamur':
                    y_train.append(1)     # 1 =
bukan_alergi_jamur
                else:
                    y_train.append(-1)    # -1 = alergi or
jamur
```

```
        X_train = np.vstack(vec)
        y_train = np.array(y_train)

        y_test = []
        vec = []
        for file in image_path_test:
            img = cv2.imread(file, 0)
            img_des = CalcFeatures(img, th)
            if img_des is not None:
                img_vec = bag_of_features(img_des, centres, k)
                vec.append(img_vec)
                if file.split('/')[2] == 'bukan_alergi_jamur':
                    y_test.append(1)     # 1 =
bukan_alergi_jamur
                else:
                    y_test.append(-1)    # -1 = alergi or
jamur
        X_test = np.vstack(vec)
        y_test = np.array(y_test)

        models[th][k] = {}

        for g in gamma:
            models[th][k][g] = {}
            for c in C:

                rbf = RBFKernelSVM(gamma=g, C=c)
                rbf.fit(X_train, y_train)
                models[th][k][g][c] = rbf

                train_preds = rbf.predict(X_train)

                train_acc = accuracy_score(y_train,
np.array(train_preds))
                train_f1 = f1_score(y_train, train_preds)
                train_conf_mat = confusion_matrix(y_train,
train_preds)

                test_preds = rbf.predict(X_test)

                test_acc = accuracy_score(y_test,
np.array(test_preds))
                test_f1 = f1_score(y_test, test_preds)
                test_conf_mat = confusion_matrix(y_test,
test_preds)
                if(test_acc > 0.70 and test_f1 > 0.70):
                    print('Calc for threshold = {} and k = {}
|| gamma = {} and C = {}'.format(th, k, g, c))
                    print('Train Data')
```

```
                    print('Accuracy = {}\nF1 Score =
{}\nConfusion matrix :\n{}'.format(train_acc*100,
train_f1*100, train_conf_mat))
                    print('Test Data')
                    print('Accuracy = {}\nF1 Score =
{}\nConfusion matrix :\n{}'.format(test_acc*100, test_f1*100,
test_conf_mat))


# Training for Model "Alergi Kulit" vs "Jamur Kulit"
reg_strengths = [1e4, 2e4, 5e4, 1e5]
learning_rates = [1e-8, 1e-7, 2e-7]

AvJcenters = {}
AvJweights = {}
AvJfeatures = {}

for th in thresh:
    AvJcenters[th] = {}
    AvJweights[th] = {}
    AvJfeatures[th] = getSIFTFeature(th, image_path_train)

    for k in k_value:
        k = int(k * th * len(image_path_train))

        criteria = (cv2.TERM_CRITERIA_EPS +
cv2.TERM_CRITERIA_MAX_ITER, 10, 0.1)
        flags = cv2.KMEANS_RANDOM_CENTERS
        compact, labels, centres = cv2.kmeans(AvJfeatures[th],
k, None, criteria, 10, flags)
        AvJcenters[th][k] = centres

        y_train = []
        vec = []
        for file in image_path_train:
            img = cv2.imread(file, 0)
            img_des = CalcFeatures(img, th)
            if img_des is not None:
                img_vec = bag_of_features(img_des, centres, k)

                if file.split('/')[2] == 'alergi_kulit':
                    vec.append(img_vec)
                    y_train.append(1)     # 1 = alergi_kulit
                elif file.split('/')[2] == 'jamur_kulit':
                    vec.append(img_vec)
                    y_train.append(-1)    # -1 = jamur_kulit
        vec = np.vstack(vec)
        intercept_col = np.ones((vec.shape[0], 1))
        X_train = np.append(vec, intercept_col, axis=1)
```

```
        y_train = np.array(y_train)

        # X_train, X_val, y_train, y_val =
train_test_split(X_data, y_data, test_size=0.25,
random_state=12, stratify=y_data)

        y_test = []
        vec = []
        for file in image_path_test:
            img = cv2.imread(file, 0)
            img_des = CalcFeatures(img, th)
            if img_des is not None:
                img_vec = bag_of_features(img_des, centres, k)

                if file.split('/')[2] == 'alergi_kulit':
                    vec.append(img_vec)
                    y_test.append(1)     # 1 = bukan alergi
dan jamur
                elif file.split('/')[2] == 'jamur_kulit':
                    vec.append(img_vec)
                    y_test.append(-1)    # -1 = alergi dan
jamur
        vec = np.vstack(vec)
        intercept_col = np.ones((vec.shape[0], 1))
        X_test = np.append(vec, intercept_col, axis=1)
        y_test = np.array(y_test)

        AvJweights[th][k] = {}

        for reg_strength in reg_strengths:
            AvJweights[th][k][reg_strength] = {}
            for learning_rate in learning_rates:
                print('Calculating for threshold = {} and k =
{} || rs: {}, lr: {}'.format(th, k, reg_strength,
learning_rate))
                W = SVMClassifier(X_train, y_train,
reg_strength, learning_rate)
                AvJweights[th][k][reg_strength][learning_rate]
= W

                train_preds = np.array([])
                for i in range(X_train.shape[0]):
                    yp = np.sign(np.dot(W, X_train[i])) #model
                    train_preds = np.append(train_preds, yp)

                train_acc = accuracy_score(y_train,
train_preds)
                train_f1 = f1_score(y_train, train_preds)
```

```
                train_conf_mat = confusion_matrix(y_train,
train_preds)


                test_preds = np.array([])
                for i in range(X_test.shape[0]):
                    yp = np.sign(np.dot(W, X_test[i])) #model
                    test_preds = np.append(test_preds, yp)

                test_acc = accuracy_score(y_test, test_preds)
                test_f1 = f1_score(y_test, test_preds)
                test_conf_mat = confusion_matrix(y_test,
test_preds)
                if(test_acc > 0.70 and test_f1 > 0.70):
                    print('Train Data')
                    print('Accuracy = {}\nF1 Score =
{}\nConfusion matrix :\n{}'.format(train_acc*100,
train_f1*100, train_conf_mat))
                    print('Test Data')
                    print('Accuracy = {}\nF1 Score =
{}\nConfusion matrix :\n{}'.format(test_acc*100, test_f1*100,
test_conf_mat))
                else:
                    print('Accuracy and F1 score below 60%')
            print('-----------------------------------------
-------')


# Pengujian model SVM
def predict_label(image_path):
    img = cv2.imread(image_path, 0)

    th = 40
    k = 334
    center_penyakit_vs_non = centers[th][k]
    model_penyakit_vs_non = models[th][k][0.1][100] #
threshold = 40 and k = 334 || gamma = 0.1 and C = 100
    img_des = CalcFeatures(img, th)
    if img_des is not None:
        X = bag_of_features(img_des, center_penyakit_vs_non,
k)
        yp = model_penyakit_vs_non.predict(X)

        if yp == -1: # Alergi or Jamur
            th = 40
            k = 668
            center_alergi_vs_jamur = AvJcenters[th][k]
```

```
            model_alergi_vs_jamur =
AvJweights[th][k][50000.0][1e-07] # threshold = 40 and k = 668
|| rs: 50000.0, lr: 1e-07
            img_des = CalcFeatures(img, th)
            if img_des is not None:
                img_vec = bag_of_features(img_des,
center_alergi_vs_jamur, k)
                X = np.transpose(np.append(img_vec,
np.ones((1,1)), axis=1))
                yp = np.sign(np.dot(model_alergi_vs_jamur, X))
                if yp == 1:
                    return 'alergi_kulit'
                else:
                    return 'jamur_kulit'

        else:
            return 'bukan_alergi_jamur'


train_preds = np.array([])
y_test = np.array([])
for image_path in image_path_test:
    yp = predict_label(image_path)
    if yp is not None:
        train_preds = np.append(train_preds, yp)
        y_test = np.append(y_test, image_path.split('/')[2])

acc = accuracy_score(y_test, train_preds)
conf_mat = confusion_matrix(y_test, train_preds)
print()
print('Accuracy : {}\nConfusion Matrix: \n{}\nResult
:\n{}'.format(acc*100, conf_mat, classification_report(y_test,
train_preds)))
```

Lampiran 2 *Source code* model klasifikasi menggunakan SVM tanpa pengelompokan *K-Means*

```
import os
import cv2
import itertools
import numpy as np
from sklearn.svm import SVC
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, confusion_matrix,
f1_score, classification_report
from sklearn.utils import shuffle


# Preparing the dataset
path = './data'
image_path = []
image_label = []
for sub_folder in os.listdir(os.path.join(path)):
    if sub_folder == '.DS_Store' or sub_folder ==
'.ipynb_checkpoints':
        continue
    sub_folder_files = os.listdir(os.path.join(path,
sub_folder))
    len_sub_folder = len(sub_folder_files) - 1
    for i, filename in enumerate(sub_folder_files):
        if filename == '.ipynb_checkpoints' or filename ==
'.DS_Store':
            continue
        image_path.append(os.path.join(path, sub_folder,
filename))
        image_label.append(sub_folder)


# Split data to train and test
image_path_train, image_path_test =
train_test_split(image_path, test_size=0.2, random_state=19,
stratify=image_label)


# Function for Feature Extraction
def CalcFeatures(img, th):
    sift = cv2.SIFT_create(th)
    kp, des = sift.detectAndCompute(img, None)
    return des

def getSIFTFeature(thresh, path):
    features = []
    for file in path:
```

```
        img = cv2.imread(file, 0)
        img_des = CalcFeatures(img, thresh)
        if img_des is not None:
            features.append(img_des)
    features = np.vstack(features)
    return features


# RBF SVM function
class RBFKernelSVM:
    def __init__(self, kernel='rbf', gamma=None, C=1):
        self.kernel = kernel
        self.gamma = gamma
        self.C = C

    def fit(self, X, y):
        n_samples, n_features = X.shape

        # Compute the kernel matrix
        if self.kernel == 'rbf':
            if self.gamma is None:
                self.gamma = 1 / n_features
            K = np.zeros((n_samples, n_samples))
            for i in range(n_samples):
                for j in range(n_samples):
                    K[i,j] = np.exp(-self.gamma *
np.linalg.norm(X[i]-X[j])**2)
        else:
            raise ValueError("Unsupported kernel function")

        # Solve the dual optimization problem using quadratic
programming
        P = np.outer(y, y) * K
        q = -np.ones(n_samples)
        G = np.vstack((-np.eye(n_samples), np.eye(n_samples)))
        h = np.hstack((np.zeros(n_samples), np.ones(n_samples)
* self.C))
        A = y.reshape(1, -1)
        A = A.astype('float')
        b = np.zeros(1)

        alpha = np.zeros(n_samples)
        from cvxopt import matrix, solvers
        solvers.options['show_progress'] = None
        sol = solvers.qp(matrix(P), matrix(q), matrix(G),
matrix(h), matrix(A), matrix(b))
        alpha = np.ravel(sol['x'])

        # Find the support vectors
```

```
        sv_indices = alpha > 1e-5
        self.support_vectors = X[sv_indices]
        self.support_vector_labels = y[sv_indices]
        self.support_vector_alpha = alpha[sv_indices]

        # Compute the bias term
        sv_index = np.argmax(self.support_vector_alpha)
        self.b = self.support_vector_labels[sv_index]
        for i in range(n_samples):
            if alpha[i] > 1e-5:
                self.b -= alpha[i] * y[i] * K[i,sv_index]
        self.b /= len(self.support_vector_alpha)

    def predict(self, X):
        if self.kernel == 'rbf':
            K = np.zeros((len(X), len(self.support_vectors)))
            for i in range(len(X)):
                for j in range(len(self.support_vectors)):
                    K[i,j] = np.exp(-self.gamma *
np.linalg.norm(X[i]-self.support_vectors[j])**2)
        else:
            raise ValueError("Unsupported kernel function")

        predictions = np.sign(np.dot(K,
self.support_vector_alpha * self.support_vector_labels) +
self.b)
        return predictions.astype(int)


# Linear SVM Function
def compute_cost(W, X, Y):
    # calculate hinge loss
    N = X.shape[0]
    distances = 1 - Y * (np.dot(X, W))
    distances[distances < 0] = 0  # equivalent to max(0,
distance)
    hinge_loss = reg_strength * (np.sum(distances) / N)

    # calculate cost
    cost = 1 / 2 * np.dot(W, W) + hinge_loss
    return cost

def calculate_cost_gradient(W, X_batch, Y_batch):
    # if only one example is passed (eg. in case of SGD)
    if type(Y_batch) == np.float64 or type(Y_batch) ==
np.int64:
        Y_batch = np.array([Y_batch])
        X_batch = np.array([X_batch])
    distance = 1 - (Y_batch * np.dot(X_batch, W))
```

```
    dw = np.zeros(len(W))
    for ind, d in enumerate(distance):
        if max(0, d) == 0:
            di = W
        else:
            di = W - (reg_strength * Y_batch[ind] *
X_batch[ind])
        dw += di
    dw = dw/len(Y_batch)  # average
    return dw

def sgd(features, outputs):
    max_epochs = 5000
    weights = np.zeros(features.shape[1])
    nth = 0
    prev_cost = float("inf")
    cost_threshold = 0.01  # in percent
    # stochastic gradient descent
    for epoch in range(1, max_epochs):
        # shuffle to prevent repeating update cycles
        X, Y = shuffle(features, outputs)
        for ind, x in enumerate(X):
            ascent = calculate_cost_gradient(weights, x,
Y[ind])
            weights = weights - (learning_rate * ascent)
        # convergence check on 2^nth epoch
        if epoch == 2 ** nth or epoch == max_epochs - 1:
            cost = compute_cost(weights, features, outputs)

            # stoppage criterion
            if abs(prev_cost - cost) < cost_threshold *
prev_cost:
                return weights
            prev_cost = cost
            nth += 1
    return weights

def SVMClassifier(X_train, y_train, reg_strength,
learning_rate):
    W = sgd(X_train, y_train)
    # print("weights are: {}".format(W))
    return W


# Training for Model “Alergi Jamur” vs “All”
reg_strengths = [1e4, 2e4, 5e4, 1e5]
learning_rates = [1e-8, 1e-7, 2e-7]

AJvAllweights = {}
```

```
AJvAllfeatures = {}

for th in thresh:
    # AvJcenters[th] = {}
    AJvAllweights[th] = {}
    AJvAllfeatures[th] = getSIFTFeature(th, image_path_train)

    y_train = []
    vec = []
    for file in image_path_train:
        img = cv2.imread(file, 0)
        img_des = CalcFeatures(img, th)
        if img_des is not None:
            img_vec = np.resize(img_des, (1, 128*th))
            if file.split('/')[2] == 'alergi_kulit' or
file.split('/')[2] == 'jamur_kulit':
                vec.append(img_vec)
                y_train.append(1)     # 1 = alergi_kulit or
jamur_kulit
            else:
                vec.append(img_vec)
                y_train.append(-1)    # -1 = other
    vec = np.vstack(vec)
    intercept_col = np.ones((vec.shape[0], 1))
    X_train = np.append(vec, intercept_col, axis=1)
    y_train = np.array(y_train)

    # X_train, X_val, y_train, y_val =
train_test_split(X_data, y_data, test_size=0.25,
random_state=12, stratify=y_data)

    y_test = []
    vec = []
    for file in image_path_test:
        img = cv2.imread(file, 0)
        img_des = CalcFeatures(img, th)
        if img_des is not None:
            img_vec = np.resize(img_des, (1, 128*th))
            if file.split('/')[2] == 'alergi_kulit' or
file.split('/')[2] == 'jamur_kulit':
                vec.append(img_vec)
                y_test.append(1)     # 1 = alergi_kulit or
jamur_kulit
            else:
                vec.append(img_vec)
                y_test.append(-1)    # -1 = other
    vec = np.vstack(vec)
    intercept_col = np.ones((vec.shape[0], 1))
    X_test = np.append(vec, intercept_col, axis=1)
```

```
    y_test = np.array(y_test)

    AJvAllweights[th] = {}

    for reg_strength in reg_strengths:
        AJvAllweights[th][reg_strength] = {}
        for learning_rate in learning_rates:
            print('Calculating for threshold = {} || rs: {},
lr: {}'.format(th, reg_strength, learning_rate))
            W = SVMClassifier(X_train, y_train, reg_strength,
learning_rate)
            AJvAllweights[th][reg_strength][learning_rate] = W

            train_preds = np.array([])
            for i in range(X_train.shape[0]):
                yp = np.sign(np.dot(W, X_train[i])) #model
                train_preds = np.append(train_preds, yp)

            train_acc = accuracy_score(y_train, train_preds)
            train_f1 = f1_score(y_train, train_preds)
            train_conf_mat = confusion_matrix(y_train,
train_preds)


            test_preds = np.array([])
            for i in range(X_test.shape[0]):
                yp = np.sign(np.dot(W, X_test[i])) #model
                test_preds = np.append(test_preds, yp)

            test_acc = accuracy_score(y_test, test_preds)
            test_f1 = f1_score(y_test, test_preds)
            test_conf_mat = confusion_matrix(y_test,
test_preds)

            if(test_acc > 0.70 or test_f1 > 0.70):
                print('Train Data')
                print('Accuracy = {}\nF1 Score = {}\nConfusion
matrix :\n{}'.format(train_acc*100, train_f1*100,
train_conf_mat))
                print('Test Data')
                print('Accuracy = {}\nF1 Score = {}\nConfusion
matrix :\n{}'.format(test_acc*100, test_f1*100,
test_conf_mat))
            else:
                print('Accuracy and F1 score below 70%')
        print('-----------------------------------------------
---')
```

```
# Training for Model “Alergi Kulit” vs “Jamur Kulit”
reg_strengths = [1e4, 2e4, 5e4, 1e5]
learning_rates = [1e-8, 1e-7, 2e-7]

AvJweights = {}
AvJfeatures = {}

for th in thresh:
    # AvJcenters[th] = {}
    AvJweights[th] = {}
    AvJfeatures[th] = getSIFTFeature(th, image_path_train)

    y_train = []
    vec = []
    for file in image_path_train:
        img = cv2.imread(file, 0)
        img_des = CalcFeatures(img, th)
        if img_des is not None:
            img_vec = np.resize(img_des, (1, 128*th))
            if file.split('/')[2] == 'alergi_kulit':
                vec.append(img_vec)
                y_train.append(1)     # 1 = alergi_kulit
            elif file.split('/')[2] == 'jamur_kulit':
                vec.append(img_vec)
                y_train.append(-1)    # -1 = jamur_kulit
    vec = np.vstack(vec)
    intercept_col = np.ones((vec.shape[0], 1))
    X_train = np.append(vec, intercept_col, axis=1)
    y_train = np.array(y_train)

    # X_train, X_val, y_train, y_val =
train_test_split(X_data, y_data, test_size=0.25,
random_state=12, stratify=y_data)

    y_test = []
    vec = []
    for file in image_path_test:
        img = cv2.imread(file, 0)
        img_des = CalcFeatures(img, th)
        if img_des is not None:
            img_vec = np.resize(img_des, (1, 128*th))
            if file.split('/')[2] == 'alergi_kulit':
                vec.append(img_vec)
                y_test.append(1)     # 1 = bukan alergi dan
jamur
            elif file.split('/')[2] == 'jamur_kulit':
                vec.append(img_vec)
                y_test.append(-1)    # -1 = alergi dan jamur
    vec = np.vstack(vec)
```

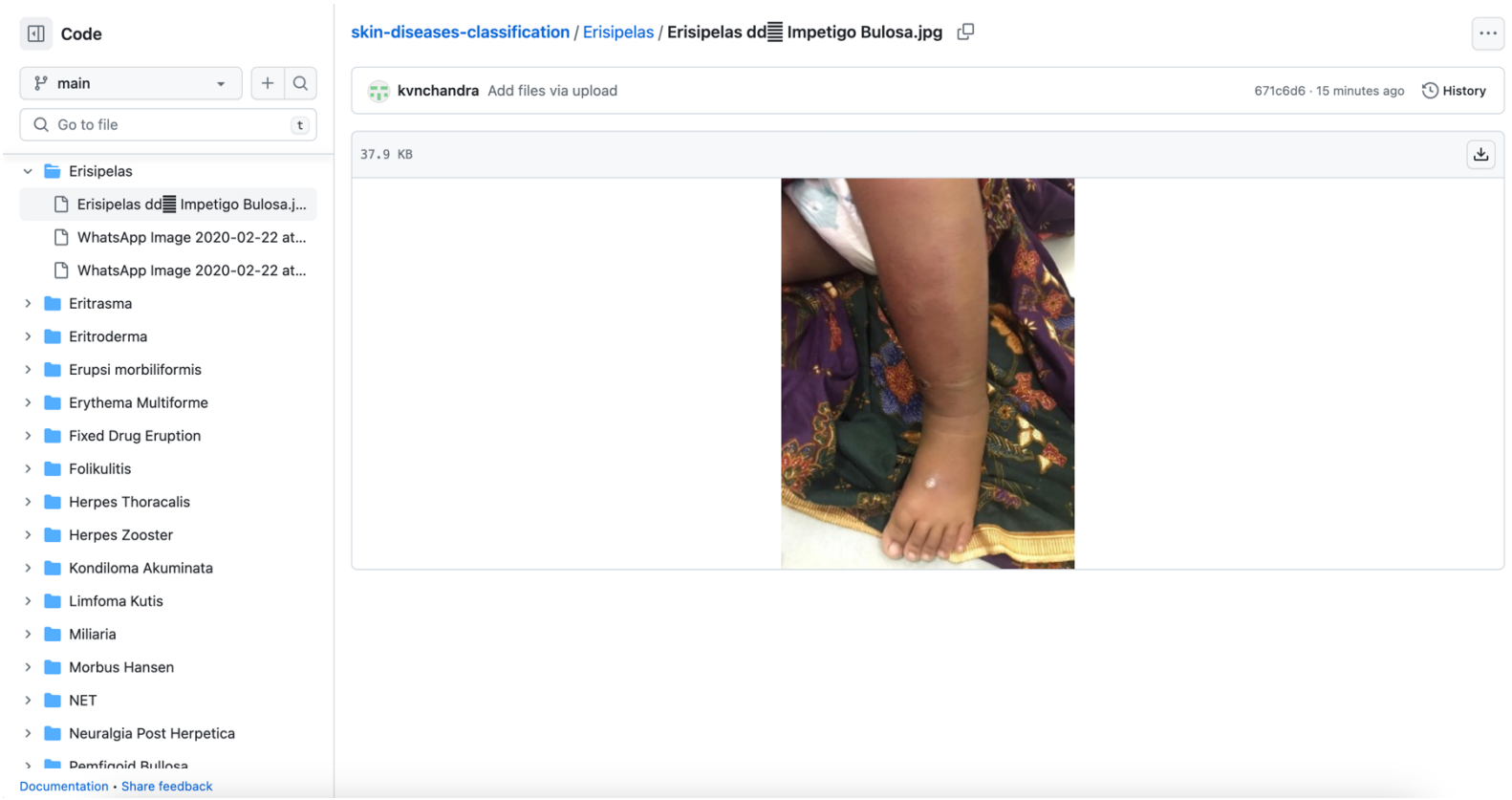
```
    intercept_col = np.ones((vec.shape[0], 1))
    X_test = np.append(vec, intercept_col, axis=1)
    y_test = np.array(y_test)

    AvJweights[th] = {}

    for reg_strength in reg_strengths:
        AvJweights[th][reg_strength] = {}
        for learning_rate in learning_rates:
            print('Calculating for threshold = {} || rs: {},
lr: {}'.format(th, reg_strength, learning_rate))
            W = SVMClassifier(X_train, y_train, reg_strength,
learning_rate)
            AvJweights[th][reg_strength][learning_rate] = W

            train_preds = np.array([])
            for i in range(X_train.shape[0]):
                yp = np.sign(np.dot(W, X_train[i])) #model
                train_preds = np.append(train_preds, yp)

            train_acc = accuracy_score(y_train, train_preds)
            train_f1 = f1_score(y_train, train_preds)
            train_conf_mat = confusion_matrix(y_train,
train_preds)


            test_preds = np.array([])
            for i in range(X_test.shape[0]):
                yp = np.sign(np.dot(W, X_test[i])) #model
                test_preds = np.append(test_preds, yp)

            test_acc = accuracy_score(y_test, test_preds)
            test_f1 = f1_score(y_test, test_preds)
            test_conf_mat = confusion_matrix(y_test,
test_preds)
            if(test_acc > 0.70 and test_f1 > 0.70):
                print('Train Data')
                print('Accuracy = {}\nF1 Score = {}\nConfusion
matrix :\n{}'.format(train_acc*100, train_f1*100,
train_conf_mat))
                print('Test Data')
                print('Accuracy = {}\nF1 Score = {}\nConfusion
matrix :\n{}'.format(test_acc*100, test_f1*100,
test_conf_mat))
            else:
                print('Accuracy and F1 score below 70%')
        print('-----------------------------------------------
---')
```

```
# Pengujian model SVM
def predict_label(image_path):
    img = cv2.imread(image_path, 0)

    # threshold = 10 || rs: 100000.0, lr: 1e-08
    th = 10
    rs = 100000.0
    lr = 1e-08
    model_penyakit_vs_non = AJvAllweights[th][rs][lr]
    img_des = CalcFeatures(img, th)
    if img_des is not None:
        img_vec = np.resize(img_des, (1, 128*th))
        X = np.transpose(np.append(img_vec, np.ones((1,1)),
axis=1))
        yp = np.sign(np.dot(model_penyakit_vs_non, X))

        if yp == 1: # Alergi or Jamur
            th = 10
            model_alergi_vs_jamur =
AvJweights[th][20000.0][1e-08] # threshold = 10 || rs:
20000.0, lr: 1e-08
            img_des = CalcFeatures(img, th)
            if img_des is not None:
                img_vec = np.resize(img_des, (1, 128*th))
                X = np.transpose(np.append(img_vec,
np.ones((1,1)), axis=1))
                yp = np.sign(np.dot(model_alergi_vs_jamur, X))
                if yp == 1:
                    return 'alergi_kulit'
                else:
                    return 'jamur_kulit'

        else:
            return 'bukan_alergi_jamur'


train_preds = np.array([])
y_test = np.array([])
for image_path in image_path_test:
    yp = predict_label(image_path)
    if yp is not None:
        train_preds = np.append(train_preds, yp)
        y_test = np.append(y_test, image_path.split('/')[2])

acc = accuracy_score(y_test, train_preds)
conf_mat = confusion_matrix(y_test, train_preds)
print()
```

```
print('Accuracy : {}\nConfusion Matrix: \n{}\nResult
:\n{}'.format(acc*100, conf_mat, classification_report(y_test,
train_preds)))
```

Lampiran 3 Data citra mentah yang digunakan

Github: https://github.com/kvnchandra/skin-diseases-classification-raw-images.git


Code
main
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Erisipelas
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WhatsApp Image 2020-02-22 at...
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Eritrasma
Eritroderma
Erupsi morbiliformis
Erythema Multiforme
Fixed Drug Eruption
Folikulitis
Herpes Thoracalis
Herpes Zooster
Kondiloma Akuminata
Limfoma Kutis
Miliaria
Morbus Hansen
NET
Neuralgia Post Herpetica
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skin-diseases-classification / Erisipelas / Erisipelas dd Impetigo Bulosa.jpg
kvnchandra Add files via upload
671c6d6 · 15 minutes ago
History
37.9 KB

Code

main

Go to file t

- Pemfigoid Bullosa
  - Andi Tenri Bullous Pemphigoid 2....
  - Andi Tenri Bullous Pemphigoid 3....
  - Andi Tenri Bullous Pemphigoid 4....
  - Andi Tenri Bullous Pemphigoid 5....
  - Andi Tenri Bullous Pemphigoid.jpg
  - Pemfigus bullosa 1.jpg
  - Pemfigus bullosa 2.jpg
  - Pemfigus bullosa 3.jpg
  - Pemfigus bullosa 5.jpg
  - Saleh Pemfigoid bulosa 2.jpg
  - Saleh Pemfigoid bulosa 3.jpg
  - Saleh Pemfigoid bulosa.jpg
  - WhatsApp Image 2020-07-18 at ...
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  - WhatsApp Image 2020-07-18 at ...
  - WhatsApp Image 2020-07-18 at

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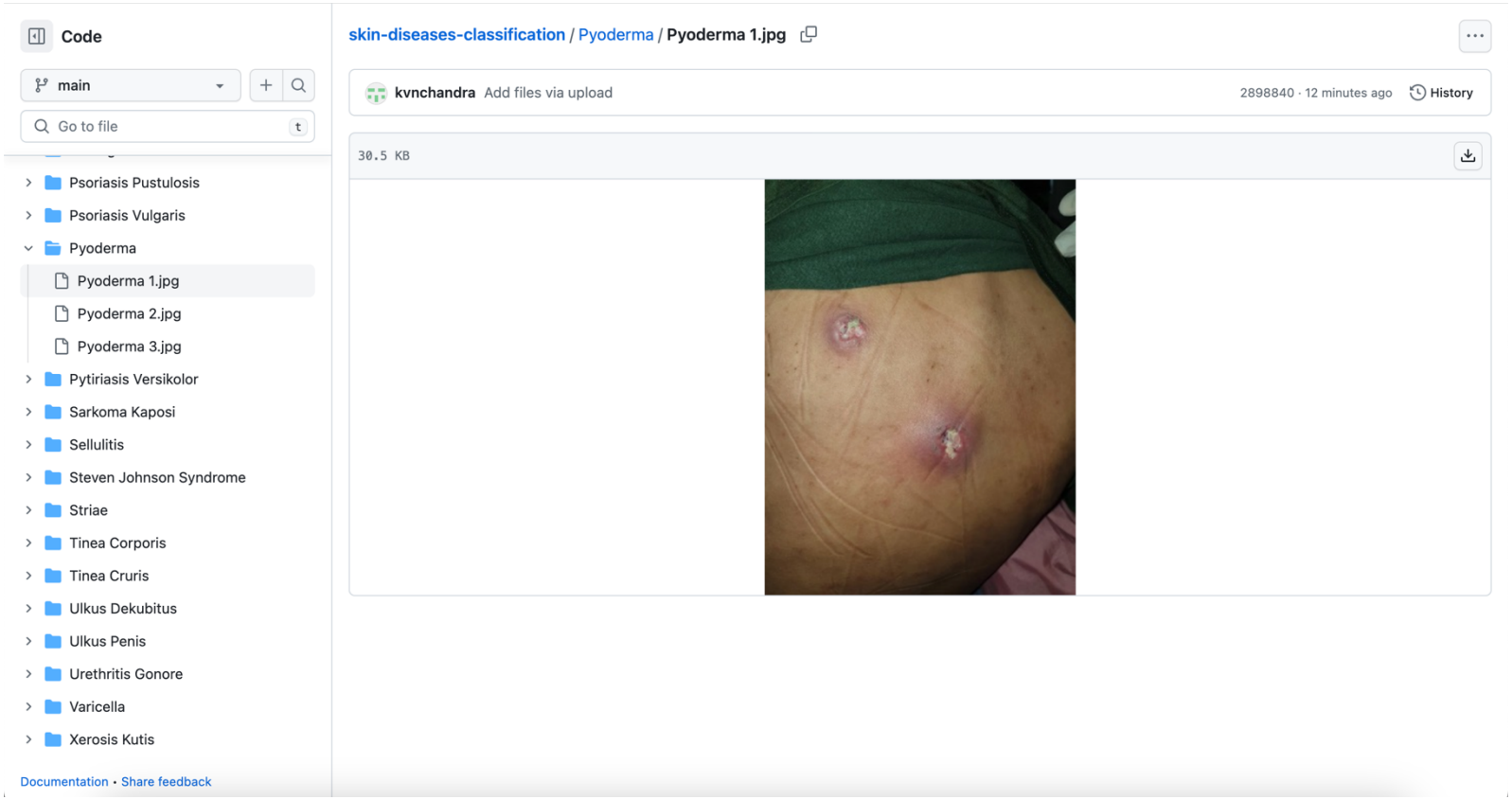
skin-diseases-classification / Pemfigoid Bullosa / Andi Tenri Bullous Pemphigoid 2.jpg

kvnchandra Add files via upload 2898840 · 11 minutes ago History

30 KB


Code
main
Go to file
t
Psoriasis Pustulosis
Psoriasis Vulgaris
Pyoderma
Pyoderma 1.jpg
Pyoderma 2.jpg
Pyoderma 3.jpg
Pytiriasis Versikolor
Sarkoma Kaposi
Sellulitis
Steven Johnson Syndrome
Striae
Tinea Corporis
Tinea Cruris
Ulkus Dekubitus
Ulkus Penis
Urethritis Gonore
Varicella
Xerosis Kutis
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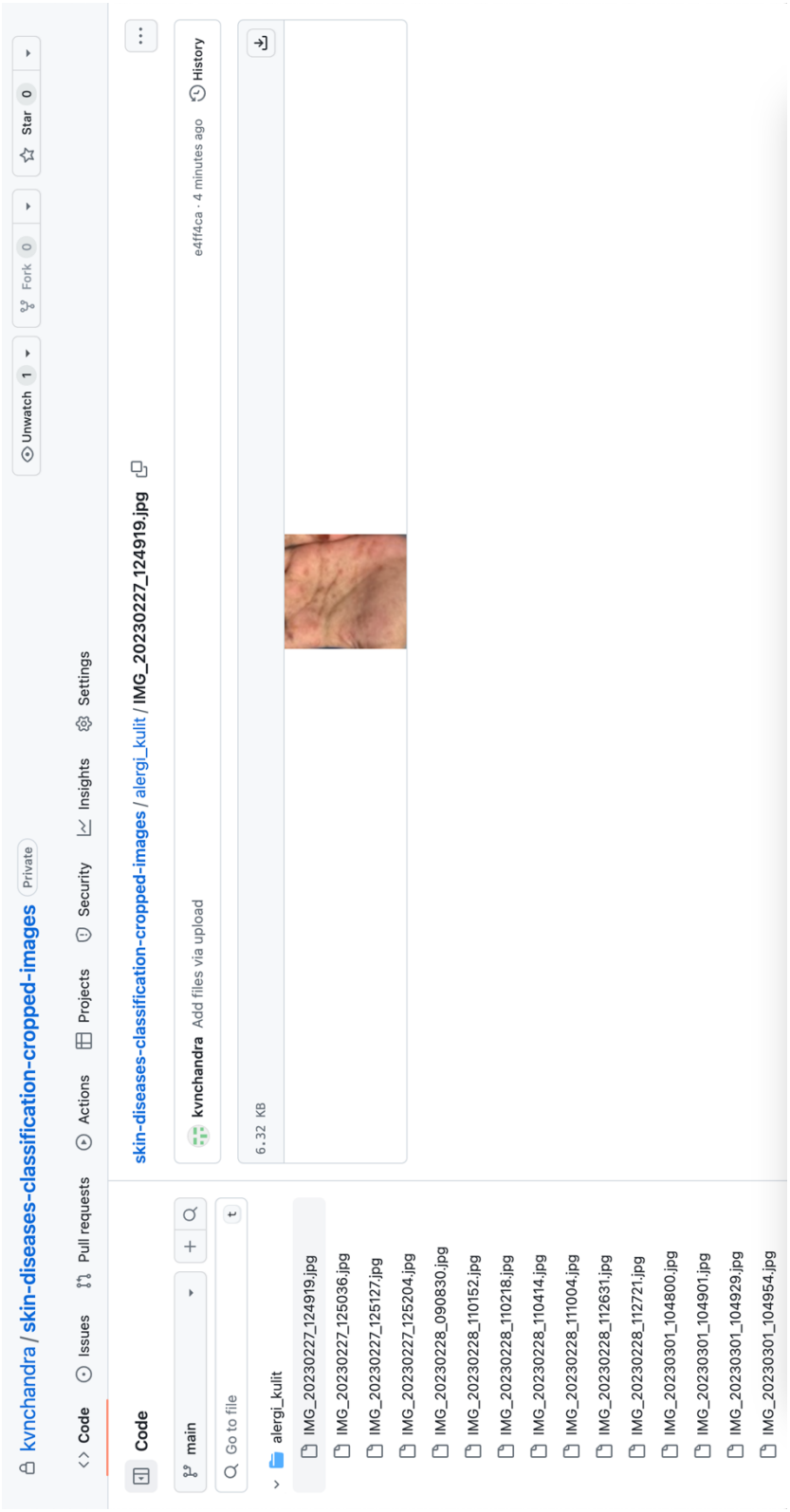
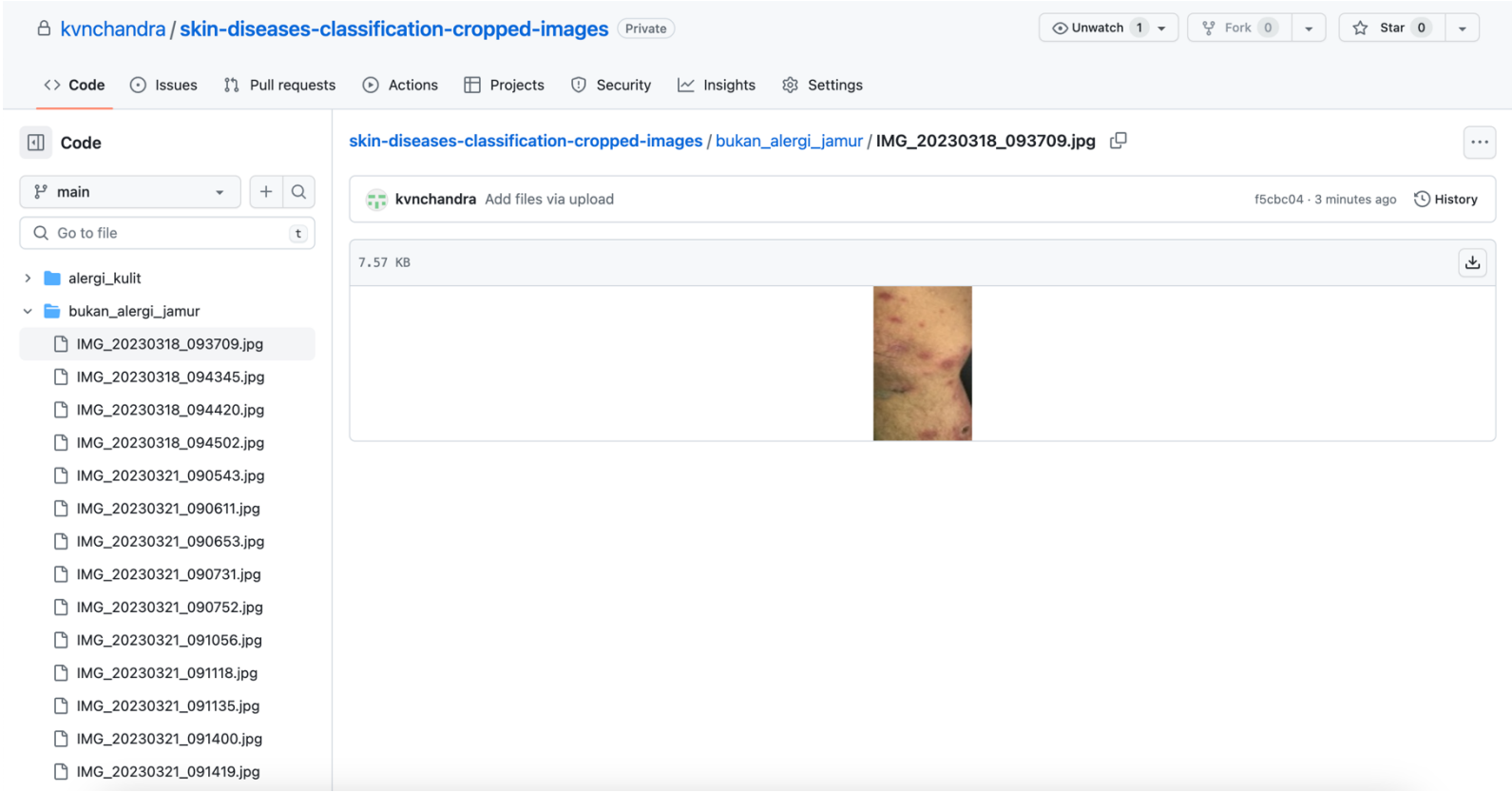
skin-diseases-classification / Pyoderma / Pyoderma 1.jpg
kvnchandra Add files via upload
2898840 · 12 minutes ago
History
30.5 KB

Lampiran 4 Data citra yang telah dilakukan proses *cropping*

Github: https://github.com/kvnchandra/skin-diseases-classification-cropped-images.git




kvnchandra / skin-diseases-classification-cropped-images
Private
Unwatch 1
Fork 0
Star 0
Code
Issues
Pull requests
Actions
Projects
Security
Insights
Settings
Code
main
Go to file
t
alergi_kulit
bukan_alergi_jamur
IMG_20230318_093709.jpg
IMG_20230318_094345.jpg
IMG_20230318_094420.jpg
IMG_20230318_094502.jpg
IMG_20230321_090543.jpg
IMG_20230321_090611.jpg
IMG_20230321_090653.jpg
IMG_20230321_090731.jpg
IMG_20230321_090752.jpg
IMG_20230321_091056.jpg
IMG_20230321_091118.jpg
IMG_20230321_091135.jpg
IMG_20230321_091400.jpg
IMG_20230321_091419.jpg
skin-diseases-classification-cropped-images / bukan_alergi_jamur / IMG_20230318_093709.jpg
kvnchandra Add files via upload
f5cbc04 · 3 minutes ago
History
7.57 KB

Code

main

Go to file t

- alergi_kulit
- bukan_alergi_jamur
- jamur_kulit
  - IMG_20230306_115756.jpg
  - IMG_20230306_115828.jpg
  - IMG_20230306_115907.jpg
  - IMG_20230306_115935.jpg
  - IMG_20230306_115953.jpg
  - IMG_20230306_120033.jpg
  - IMG_20230306_120048.jpg
  - IMG_20230306_120117.jpg
  - IMG_20230306_120138.jpg
  - IMG_20230306_120201.jpg
  - IMG_20230306_120230.jpg
  - IMG_20230306_120304.jpg
  - IMG_20230306_120325.jpg
  - IMG_20230306_120359.jpg
  - IMG_20230306_120425.jpg
  - IMG_20230306_120456.jpg

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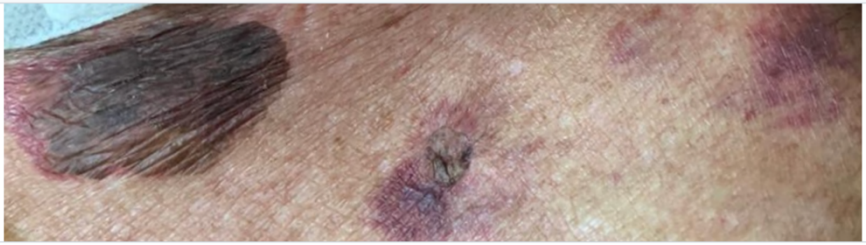
skin-diseases-classification-cropped-images / jamur_kulit / IMG_20230306_120117.jpg

kvnchandra Add files via upload b4a5328 · 4 minutes ago History

83 KB



LEMBAR PERBAIKAN SKRIPSI

"KLASIFIKASI PENYAKIT PADA CITRA KULIT MENGGUNAKAN METODE SUPPORT VECTOR MACHINE"

OLEH:

KEVIN CHANDRA
D42116311

Skripsi ini telah dipertahankan pada Ujian Akhir Sarjana tanggal 24 Juli 2023.

Telah dilakukan perbaikan penulisan dan isi skripsi berdasarkan usulan dari penguji dan pembimbing skripsi.

Persetujuan perbaikan oleh tim penguji:

	Nama	Tanda Tangan
Ketua	Dr. Ir. Ingrid Nurtanio, M.T.	
Sekretaris	Anugrayani Bustamin, S.T., M.T.	
Anggota	Dr. Ir. Zahir Zainuddin, M.Sc.	
	Dr. Amil Ahmad Ilham, S.T., M.IT.	

Persetujuan Perbaikan oleh pembimbing:

Pembimbing	Nama	Tanda Tangan
I	Dr. Ir. Ingrid Nurtanio, M.T.	
II	Anugrayani Bustamin, S.T., M.T.	