פרמטרים:

```
# params
IMAGE_SIZE = 227
NUM_CHANELLS = 3
LEN_FEATURES = IMAGE_SIZE * IMAGE_SIZE * NUM_CHANELLS
NUM_OF_EPOCHS = 30
ZISE_OF_IMAGES = 9000
BATCH_SIZE = 32
LEARNING_RATE = 0.000001
CLASSES = ['happy', 'sad']
```

ערבוב דאטא:

```
train_images, train_labels = shuffle(train_images, train_labels)
```

נורמליזציה:

```
x_train = train_images.astype('float32') / 255.0
y_train = np.asarray(train_labels).astype('float32').reshape((-1,1))
```

מודל:

```
model = tf.keras.Sequential()

model.add(tf.keras.layers.Conv2D(96, (3, 3), strides=(2, 2), padding='valid', activation='relu', input_shape=x_train.shape[1:]))
model.add(tf.keras.layers.BatchNormalization())
model.add(tf.keras.layers.MaxPooling2D(pool_size=(3, 3), strides=(2, 2)))

model.add(tf.keras.layers.Conv2D(256, (3, 3), strides=(2, 2), padding='same', activation='relu'))
model.add(tf.keras.layers.BatchNormalization())
model.add(tf.keras.layers.MaxPooling2D(pool_size=(3, 3), strides=(2, 2)))

model.add(tf.keras.layers.Conv2D(384, (3, 3), padding='same', activation='relu'))
model.add(tf.keras.layers.BatchNormalization())

model.add(tf.keras.layers.Conv2D(256, (3, 3), padding='same', activation='relu'))
model.add(tf.keras.layers.BatchNormalization())
model.add(tf.keras.layers.MaxPooling2D(pool_size=(3, 3), strides=(3, 2)))



model.add(tf.keras.layers.Conv2D(256, (3, 3), padding='same', activation='relu'))
model.add(tf.keras.layers.Dropout(0.5))
model.add(tf.keras.layers.GlobalAveragePooling2D())


model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(4096, activation='relu'))
model.add(tf.keras.layers.Dense(1, activation='sigmoid'))

# optimizer = tf.keras.optimizers.Adam()
# model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])
model.compile(optimizer=tf.keras.optimizers.Adam(learning_rate=0.0001), loss='binary_crossentropy', metrics=['accuracy'])
```

סיכום מודל:

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_5 (Conv2D)           (None, 113, 113, 96)      2688

 batch_normalization_4 (Batc  (None, 113, 113, 96)     384
 hNormalization)

 max_pooling2d_3 (MaxPooling  (None, 56, 56, 96)       0
 2D)

 conv2d_6 (Conv2D)           (None, 28, 28, 256)       221440

 batch_normalization_5 (Batc  (None, 28, 28, 256)      1024
 hNormalization)

 max_pooling2d_4 (MaxPooling  (None, 13, 13, 256)      0
 2D)

 conv2d_7 (Conv2D)           (None, 13, 13, 384)       885120

 batch_normalization_6 (Batc  (None, 13, 13, 384)      1536
 hNormalization)

 conv2d_8 (Conv2D)           (None, 13, 13, 256)       884992

 batch_normalization_7 (Batc  (None, 13, 13, 256)      1024
 hNormalization)

 max_pooling2d_5 (MaxPooling  (None, 4, 6, 256)        0
 2D)

 conv2d_9 (Conv2D)           (None, 4, 6, 256)         590080

 dropout_1 (Dropout)         (None, 4, 6, 256)         0

 global_average_pooling2d_1   (None, 256)              0
 (GlobalAveragePooling2D)

 flatten_1 (Flatten)         (None, 256)               0

 dense_2 (Dense)             (None, 4096)              1052672

 dense_3 (Dense)             (None, 1)                 4097

=================================================================
Total params: 3,645,057
Trainable params: 3,643,073
Non-trainable params: 1,984
_________________________________________________________________
```

אימון של המודל:

```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath=MODEL_HISTORY_FILEPATH,
    monitor='val_accuracy',
    mode='auto',
    save_best_only=True
    )

train_scores = model.fit(x_train, y_train, batch_size=BATCH_SIZE, epochs=NUM_OF_EPOCHS, shuffle=True, validation_split=0.2, callbacks=[model_checkpoin
```

תוצאות ב-PDF