Implementation of multilayer Perceptron

Course :Connectionist Networks

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Academic Info

Master 1 GDIL/R2SD
2024 - 2025

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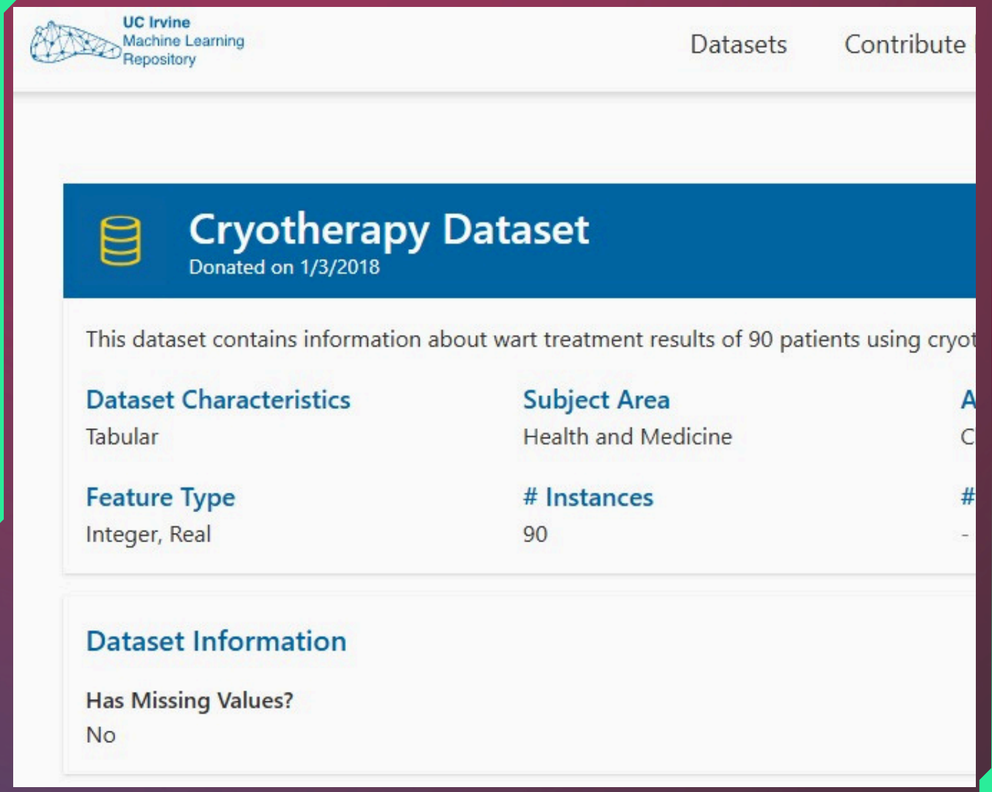
Dataset

	A	B	C	D	E	F	G
1	sex	age	Time	Number_of_Warts	Type	Area	Result_of_Treatment
2	1	35	12	5	1	100	0
3	1	29	7	5	1	96	1
4	1	50	8	1	3	132	0
5	1	32	11,75	7	3	750	0
6	1	67	9,25	1	1	42	0
7	1	41	8	2	2	20	1
8	1	36	11	2	1	8	0
9	1	59	3,5	3	3	20	0
10	1	20	4,5	12	1	6	1
11	2	34	11,25	3	3	150	0
12	2	21	10,75	5	1	35	0
13	2	15	6	2	1	30	1
14	2	15	2	3	1	4	1
15	2	15	3,75	2	3	70	1
16	2	17	11	2	1	10	0
17	2	17	5,25	3	1	63	1
18	2	23	11,75	12	3	72	0
19	2	27	8,75	2	1	6	0
20	2	15	4,25	1	1	6	1
21	2	18	5,75	1	1	80	1
22	1	22	5,5	2	1	70	1



What is Cryotherapy?

A medical treatment that uses extreme cold to destroy abnormal tissues

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Tools & Libraries Used

TensorFlow

Pandas

NumPy

Keras

matplotlib

Tkinter

Programming Language::

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Preprocessing Workflow

```python
# Charger les données
df = pd.read_excel("Cryotherapy.xlsx")
print("Colonnes :", df.columns.tolist())

# Encodage one-hot (pour 'sex' et 'Type')
df_encoded = pd.get_dummies(df, columns=['sex', 'Type'], drop_first=True)

# Séparation features / target
X = df_encoded.drop("Result_of_Treatment", axis=1)
y = df_encoded["Result_of_Treatment"]

# Split train/test
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)
```

```python
# Normalisation
scaler = StandardScaler()
X_train = pd.DataFrame(scaler.fit_transform(X_train), columns=X_train.columns)
X_test = pd.DataFrame(scaler.transform(X_test), columns=X_test.columns)

# Conversion float32
X_train = X_train.astype("float32")
X_test = X_test.astype("float32")
y_train = y_train.astype("float32")
y_test = y_test.astype("float32")

test_data = X_test.copy()
test_data["Result_of_Treatment"] = y_test.values

# Enregistrer dans un fichier Excel
test_data.to_excel("donnees_test.xlsx", index=False)
print("✅ Fichier 'donnees_test.xlsx' sauvegardé avec succès.")
```

- ***Import the dataset using Pandas (Cryotherapy.xlsx).***
- **Split data into Training (80%) and Testing (20%) sets**
- **Normalize features using StandardScaler .**
- **Save processed files: training_data.xlsx and test_data.xlsx.**

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```
model = Sequential([
    Dense(16, input_dim=X_train.shape[1], activation='relu',
          kernel_regularizer=regularizers.l2(0.01)),
    Dropout(0.3),
    Dense(8, activation='relu',
          kernel_regularizer=regularizers.l2(0.01)),
    Dropout(0.2),
    Dense(1, activation='sigmoid')
])

model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])

early_stop = EarlyStopping(monitor='val_loss', patience=5, restore_best_weights=True
```

Perceptron Structure

- ***Input Layer: 7 neurons (one for each feature).***
- ***Hidden Layer 1: Dense(16, ReLU)***
- ***Hidden Layer 2: Dense(8, ReLU)***
- ***Output Layer: Dense(1, Sigmoid) for binary classification***

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History Tracking


```
history = model.fit(
    X_train, y_train,
    epochs=100,
    batch_size=16,
    validation_split=0.2,
    callbacks=[early_stop],
    verbose=1
)
```

- ***Training the model with 100 epochs***
- ***Using batch size of 16 and 20% validation split***
- ***Early stopping callback to prevent overfitting***

```
# === 5. Évaluation ===

loss, accuracy = model.evaluate(X_test, y_test)
print(f"\nPrécision sur les données de test : {accuracy:.2f}")

# Prédictions
y_pred_prob = model.predict(X_test)
y_pred = (y_pred_prob > 0.5).astype(int)

print("Accuracy (sklearn):", accuracy_score(y_test, y_pred))
```

```
Précision sur les données de test : 0.89
1/1 [==============================] - 0s 135ms/step
Accuracy (sklearn): 0.8888888888888888
1/1 [==============================] - 0s 66ms/step
```

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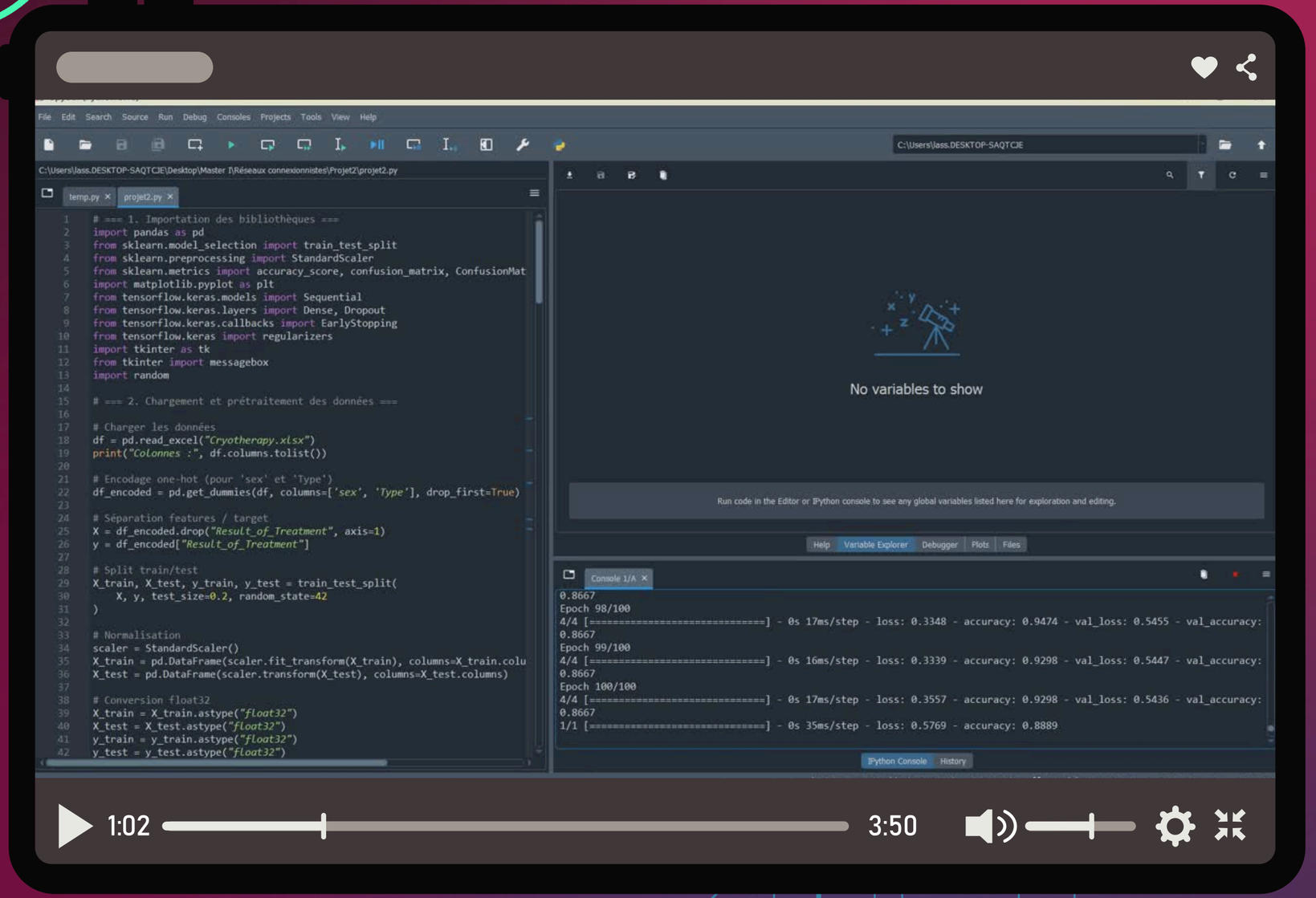
Results



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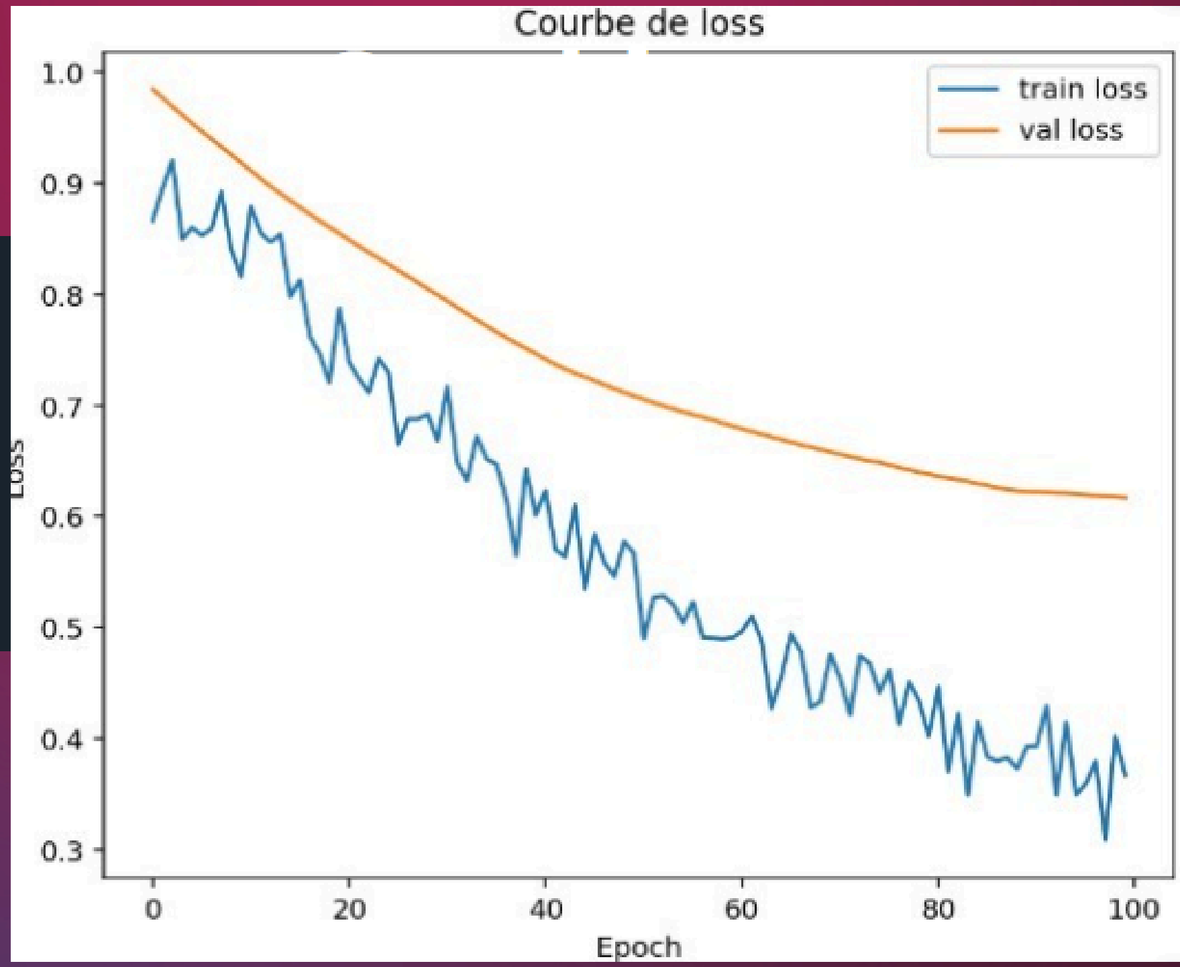
Graphics

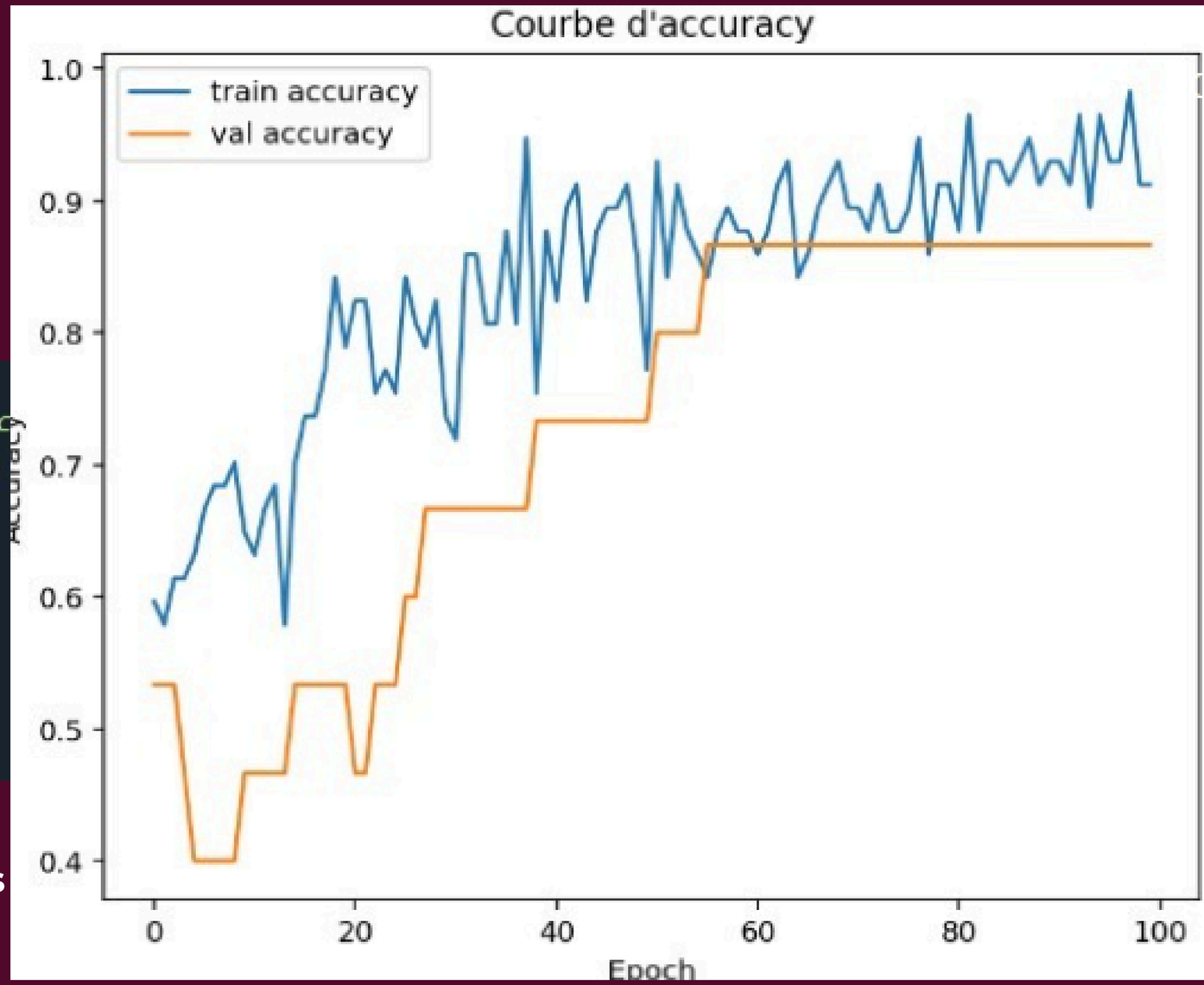

```
plt.subplot(1, 2, 1)
plt.plot(history.history['loss'], label='train loss')
plt.plot(history.history['val_loss'], label='val loss')
plt.title('Courbe de loss')
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.legend()
```



how the model's error (loss) decreases over epochs for training and validation

Graphics

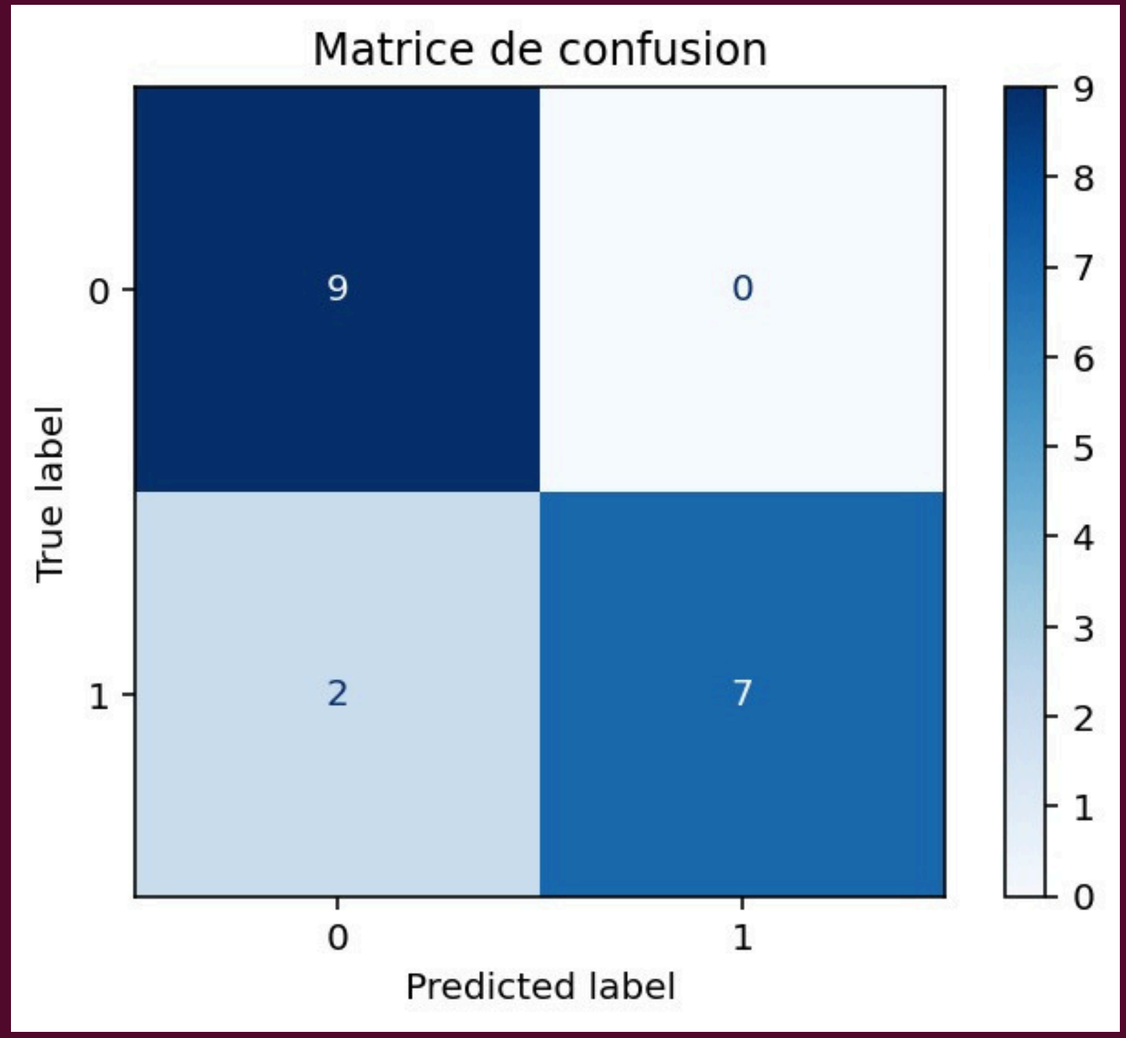
```
plt.subplot(1, 2, 2)
plt.plot(history.history['accuracy'], label='train ac
plt.plot(history.history['val_accuracy'], label='val
plt.title('Courbe d\'accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()

plt.tight_layout()
plt.show()
```



how the model’s prediction accuracy improves over epochs for training and validation

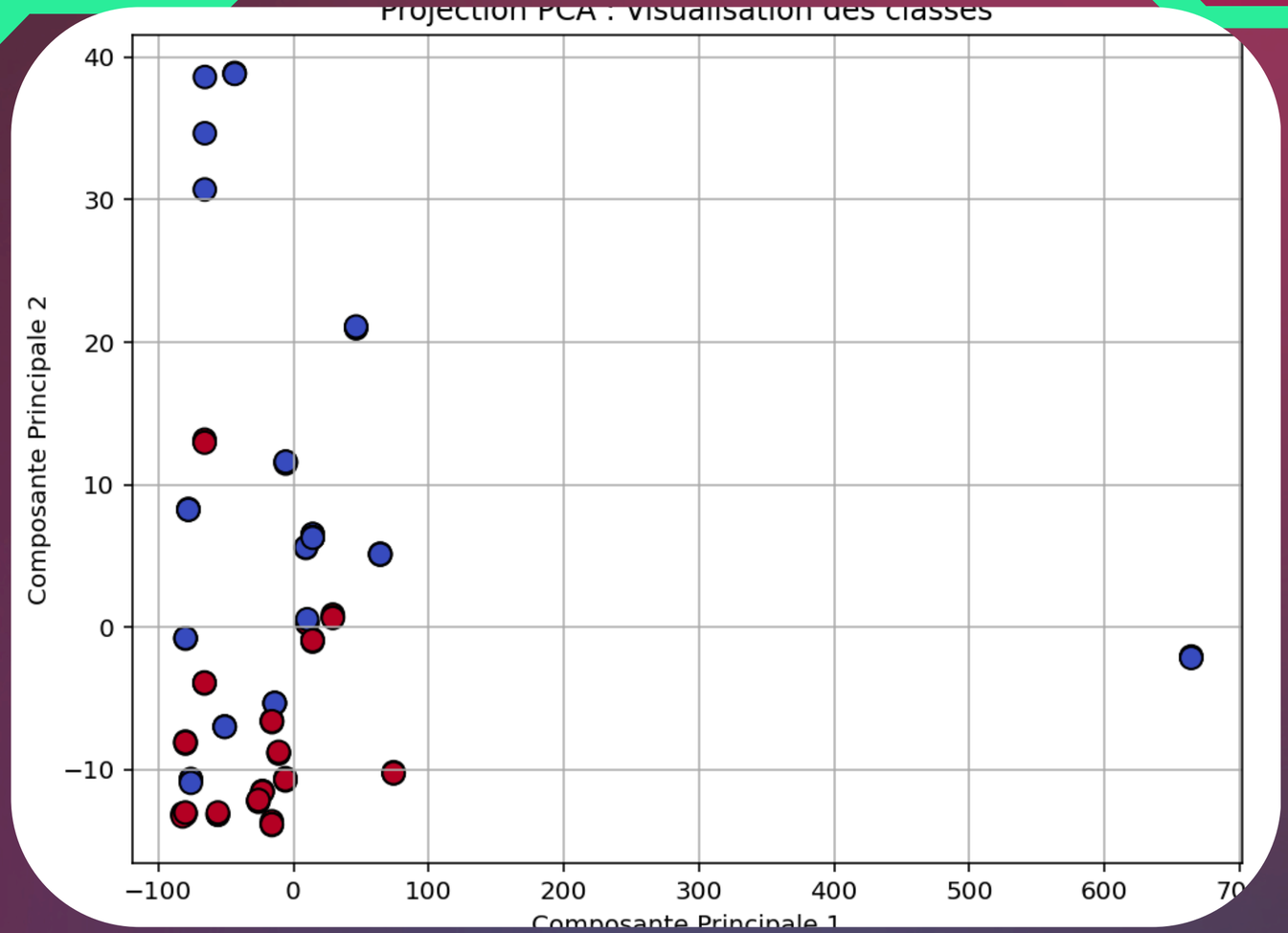
Graphics

```
# Matrice de confusion
cm = confusion_matrix(y_test, y_pred)
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=[0, 1])
disp.plot(cmap=plt.cm.Blues)
plt.title("Matrice de confusion")
plt.show()
```



the number of correct and incorrect predictions for each class (0 or 1)

Graphics



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Graphical User Interface

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27	2	34	12	3	3	95	0

Cryotherapy Prediction

Cryotherapy Prediction

Âge :

34.0

Durée (Time) :

12.0

Nombre de verrues :

3.0

Zone totale :

95.0

Sexe :

Homme

Femme

Type de verrue :

Type 3

Résultat de la prédiction

✕ Échec du traitement
(Probabilité : 0.44)

OK

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Graphical User Interface

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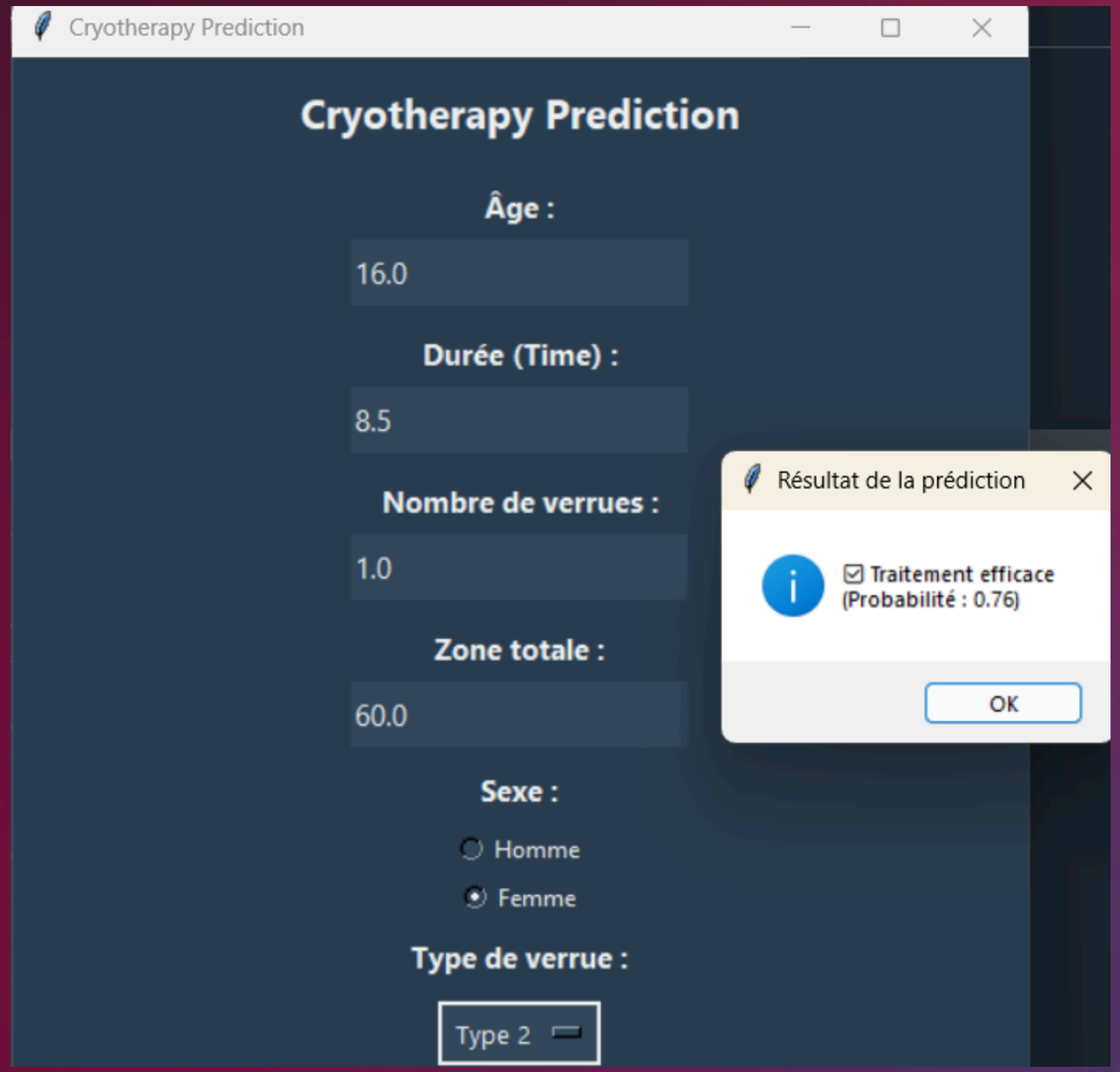
23	2	16	8,5	1	2	60	1



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Thank You!