

**Operation Manual for Prognostic Prediction System
After Mechanical Thrombectomy in Patients with
Posterior Circulation Large Vessel Occlusion**

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1 System Introduction

The incidence of stroke is rising annually, with approximately 33 million individuals affected globally each year. Ischemic stroke comprises about 70-80% of all stroke cases. Among these, acute posterior circulation large vessel occlusion represents a rare yet devastating condition, accounting for approximately 1% of all strokes. Alarming, nearly 80% of patients with this condition face either death or severe disability shortly after symptom onset.

To address this critical issue, we have developed a prognostic prediction system tailored for patients with posterior circulation large vessel occlusion who undergo mechanical thrombectomy. This system utilizes advanced machine learning ensemble algorithms to analyze demographic data, laboratory results, and imaging indicators. It automatically generates individualized predictions of functional outcomes for patients undergoing mechanical thrombectomy within 24 hours of symptom onset, focusing specifically on the three-month period following the procedure. The system is designed to aid clinical decision-making and to provide crucial prognostic information to both patients and their families.

This prognostic prediction system is implemented as a web-based application that is user-friendly, efficient, and accessible, allowing users to process relevant data and generate prognostic predictions anytime and anywhere. By facilitating timely and informed decisions in clinical settings, this tool aims to improve patient care and outcomes for those affected by posterior circulation large vessel occlusion.

2 Function Introduction

2.1 User Login

Select the "Register" button in the left sidebar, and enter a new username and password to create a new account, as illustrated in the image below:

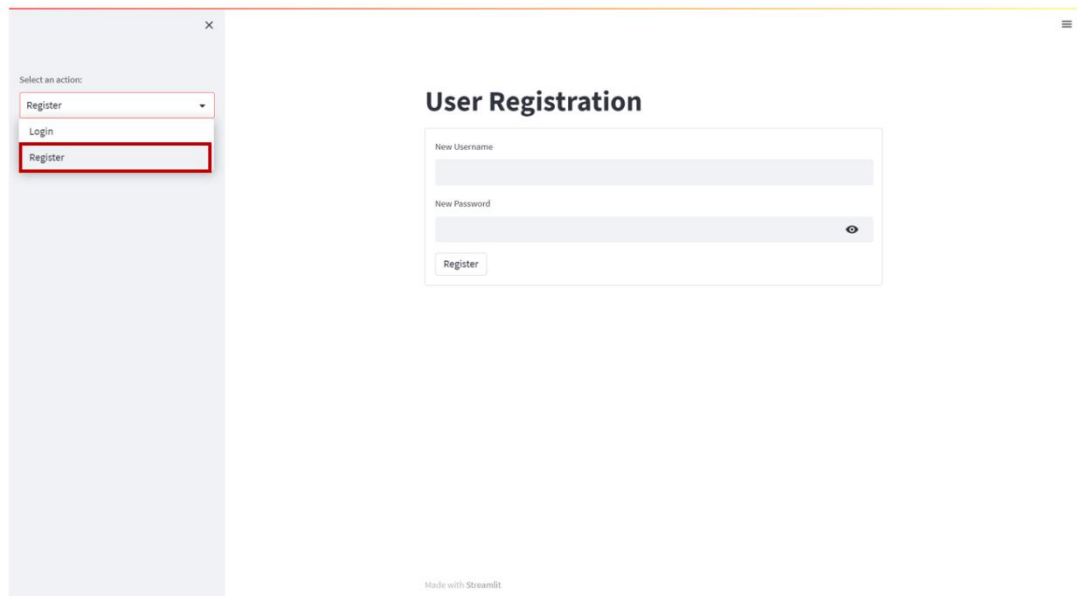
The image shows a web application interface. On the left is a sidebar with a light blue background. At the top of the sidebar is a close button (X). Below it is a section titled "Select an action:" containing a dropdown menu. The dropdown menu is open, showing three options: "Register", "Login", and "Register". The bottom "Register" option is highlighted with a red rectangular border. The main content area has a white background. At the top right is a hamburger menu icon. The main heading is "User Registration". Below it is a form with two input fields: "New Username" and "New Password". The "New Password" field has a toggle icon (an eye) on its right side. Below the input fields is a "Register" button. At the bottom center of the page, there is a small text that says "Made with Streamlit".

Figure 1

If you already have an account, please click the "Login" button to access the login page. Enter your username and password to successfully log in, as shown in the image

below:

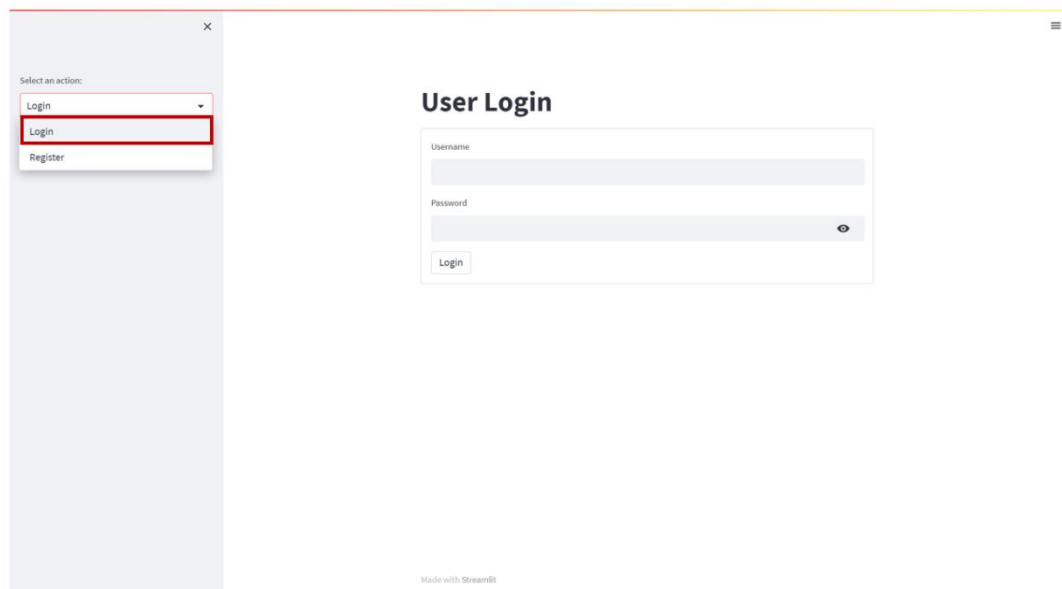


Figure 2

2.2 Homepage Interface

After logging in, users will be taken to the homepage, which offers a brief introduction to the system, its features, usage instructions, and contact information. Users can download the user manual by clicking the "User Manual" button, and they can access relevant webpages by clicking the links under "Useful

Links."

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Select a Page

Home Page

Welcome to Functional outcome prediction App for patients with posterior circulation large vessel occlusion after mechanical thrombectomy

Summary

This application aims to predict functional outcome in patients with posterior circulation large vessel occlusion following mechanical thrombectomy, thus facilitates informed clinical judgment, supports personalized treatment and follow-up plans, and establishes realistic treatment expectations.

Main Features

- ✔ Implementation of preoperative, intraoperative, and postoperative prediction models to dynamically update predictions of functional outcomes.
- ✔ Support for batch predictions of functional outcomes for multiple patients.
- ✔ Ability to predict outcomes for patients with missing variable values.
- ✔ Facilitation of the interpretation of how the model provides personalized predictions for specific cases.
- ✔ Consideration of changing environments with automatic deployment of updated prediction models.

How to Use

To the left, is a dropdown main menu for navigating to each page in the present App:

- Home Page: We are here!
- Prediction: Overview of the prediction section.
- Preoperative_number: Manage preoperative predictions by inputting the necessary data.
- Preoperative_batch: Process preoperative batch predictions by uploading a file.
- Perioperative_number: Manage perioperative predictions by inputting the necessary data.
- Perioperative_batch: Process perioperative batch predictions by uploading a file.
- Postoperative_number: Manage postoperative predictions by inputting the necessary data.
- Postoperative_batch: Process postoperative batch predictions by uploading a file.

Click here to download the manual for more detailed usage instructions:

User Manual.pdf

Contact Us


If you have any questions, please contact the support team:

- Email: 2694683001@qq.com

Useful Links

An app designed to predict functional outcomes for patients with anterior circulation large vessel occlusion following mechanical thrombectomy:

- [Visit our partner site](#)



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Figure 3

2. 3 Select Data Input Method

Users can access the prediction interface by selecting the option from the left sidebar and clicking the "Prediction" button. This system provides three predictive models — preoperative, intraoperative, and postoperative — to assess the prognosis of patients with occlusion of the large vessels in the posterior circulation who are undergoing thrombectomy. Each model offers two different methods for data input, allowing users to select their preferred format. For example, "Preoperative_number" is for single input, while "Preoperative_batch" allows for batch input, and so forth. This is illustrated in the image below:

Functional outcome prediction App
for patients with posterior
circulation large vessel occlusion
after mechanical thrombectomy

Preoperative Number Prediction

This section will manage preoperative predictions by inputting the necessary data. Please fill in the blanks with corresponding data. After that, click on the Predict button at the bottom to see the prediction of the classifier.

NIHSS
10

GCS
10

pre_eGFR
111.50

pre_glucose
7.78

PC_ASPECTS
8.00

Age
60

pre_BUN
10.20

Predict

Outcome for Learning
0

Add Data for Learning

Made with Streamlit

Manage app

Figure 4

2.4 Manual Data Input Prediction

2.4.1 Data input

By clicking the "Number" button in the left selection bar, users will access the prediction interface for manually entering single data points. In the variable fields, users can input the relevant data and then press the "Predict" button. This will display the predicted probability of a favorable postoperative prognosis for the patient, along with the corresponding SHAP force plot and SHAP values for each variable. A positive SHAP value indicates that the feature contributes positively to the model's prediction, increasing the predicted output. In contrast, a negative SHAP value suggests that the feature has a detrimental effect, decreasing the predicted output. This is illustrated using the preoperative prediction model, as shown in the image below:

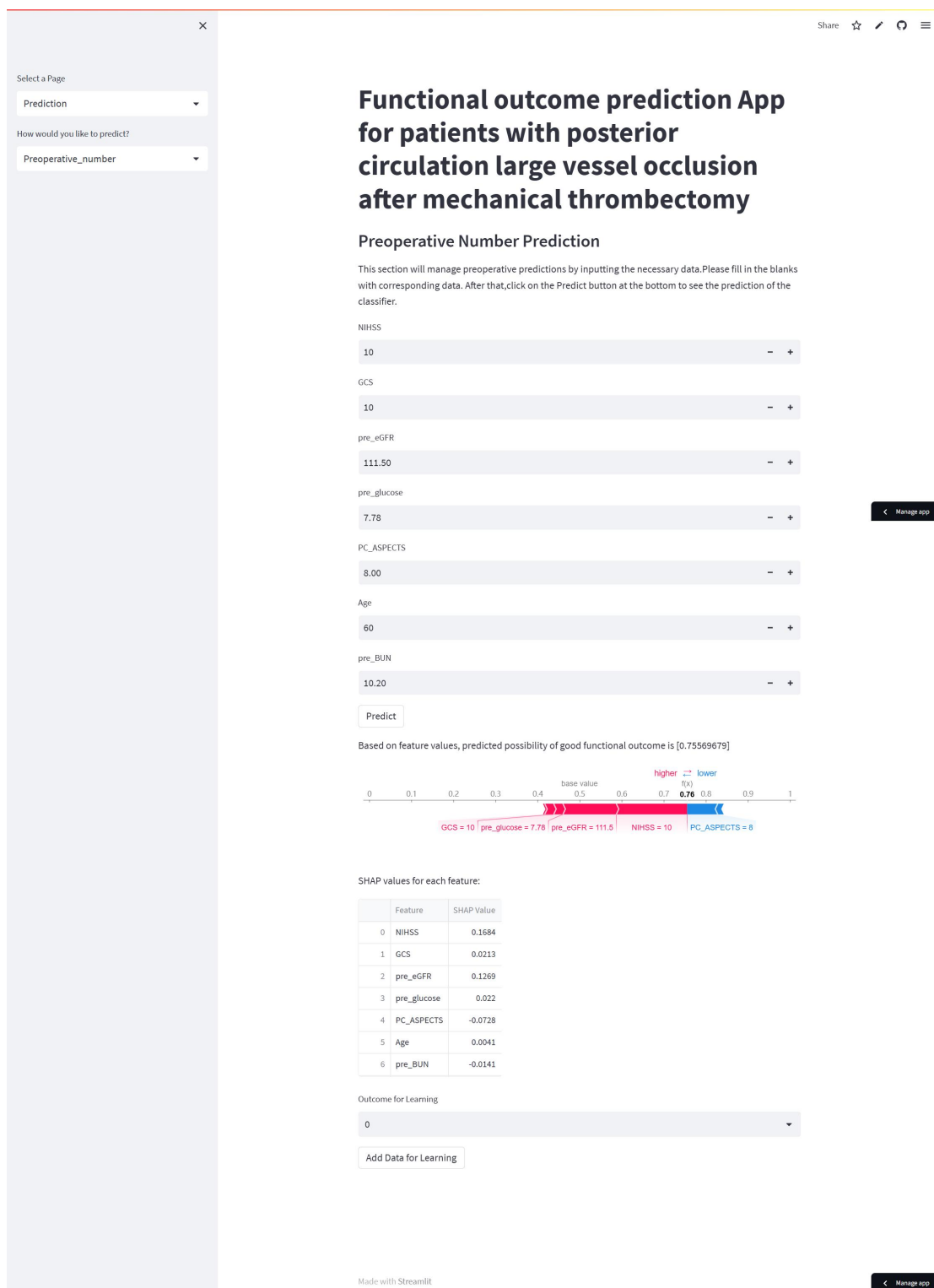


Figure 5

2.4.2 Model update

The system allows users to input the actual outcomes of patient follow-ups to assess and update the model's performance in real time. Users can click the "Outcome for Learning" button in the selection bar below to report the actual outcomes. They should input "1" when the actual outcome is favorable and "0" when it is unfavorable, as shown in the image below:

Functional outcome prediction App for patients with posterior circulation large vessel occlusion after mechanical thrombectomy

Preoperative Number Prediction

Please fill in the blanks with corresponding data.

NIHSS

10

GCS

10

pre_eGFR

111.50

pre_glucose

7.78

PC_ASPECTS

8.00

Age

60

pre_BUN

10.20

Predict

Outcome for Learning

0

Add Data for Learning

Accumulated training data preview:

	NIHSS	GCS	pre_eGFR	pre_glucose	PC_ASPECTS	Age	pre_BUN	label
0	10	10	111.5	7.78	8	60	10.2	0

Not enough data to apply incremental learning. Please provide at least 10 samples.

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Figure 6

When the sample size added by the user is greater than 10 and the AUC of the model on that batch of users is lower than the set threshold, the system will automatically update the model based on the data provided by the user.

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Select a Page

Prediction

How would you like to predict?

Preoperative_number

Functional outcome prediction App for patients with posterior circulation large vessel occlusion after mechanical thrombectomy

Preoperative Number Prediction

Please fill in the blanks with corresponding data.

NIHSS

10

- +

GCS

10

- +

pre_eGFR

111.50

- +

pre_glucose

7.78

- +

PC_ASPECTS

8.00

- +

Age

60

- +

pre_BUN

10.20

- +

Predict

Outcome for Learning

1

Add Data for Learning

Accumulated training data preview:

	NIHSS	GCS	pre_eGFR	pre_glucose	PC_ASPECTS	Age	pre_BUN	label
0	10	10	111.5	7.78	8	60	10.2	0
1	10	10	111.5	7.78	8	60	10.2	1
2	10	10	111.5	7.78	8	60	10.2	1
3	10	10	111.5	7.78	8	60	10.2	1
4	10	10	111.5	7.78	8	60	10.2	0
5	10	10	111.5	7.78	8	60	10.2	0
6	10	10	111.5	7.78	8	60	10.2	0
7	10	10	111.5	7.78	8	60	10.2	1
8	10	10	111.5	7.78	8	60	10.2	1
9	10	10	111.5	7.78	8	60	10.2	1

Initial model AUC on new data: 0.5000

Initial model AUC is below 0.78. Starting incremental learning.

Saving model to global_weighted_forest.pkl

Model updated successfully with incremental learning!

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Manage app

Figure 7

After the model is automatically updated, click the predict button again to enable the updated model for prediction. We can see that the predicted results have changed compared to Figure 5.

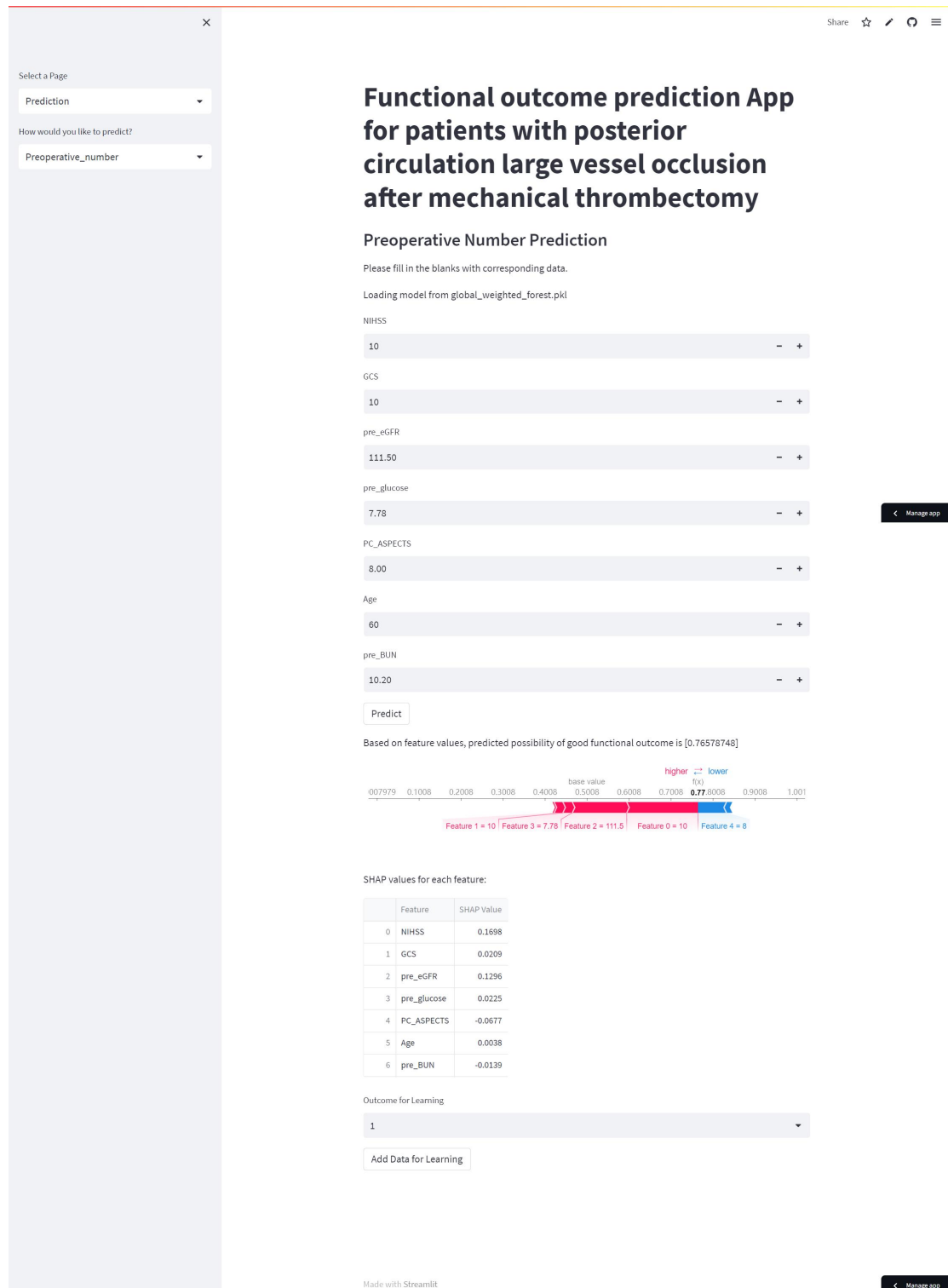


Figure 8

2.5 Table Upload Data Prediction

2.5.1 Download the form

By clicking the "Batch" button in the selection bar on the left, users will access the data upload prediction interface. To download a CSV format template for the postoperative model, simply click the link below the image, as illustrated in the following example:

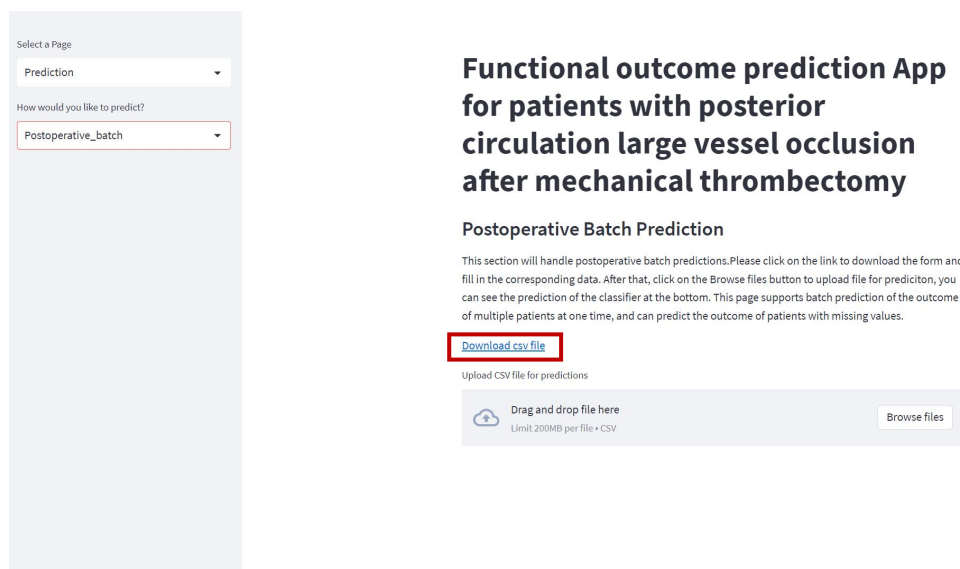


Figure 9

In the downloaded CSV template, fill in the required values for the corresponding indicators in order. This prediction system can perform prognostic assessments for patients with missing values; if any data is unavailable, simply leave the corresponding field blank. Furthermore, the system supports batch predictions for multiple patients, allowing you to enter data for each patient sequentially. Once you have completed all the entries, click "Save" and ensure the file is saved in CSV format, as illustrated in the image below:

	A	B	C	D	E	F	G
1	Age	GCS	PC_ASPECTS	procedural time	post_eGFR	post_NIHSS	
2	60	15	10	60	70	12	
3	70	10		110	69	10	
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Figure 10

2.5.2 Upload form

Return to the prediction system interface, click the "Browse files" button to upload the spreadsheet, or drag the CSV file below the image to import the data.

Select a Page

Prediction

How would you like to predict?

Postoperative_batch

Functional outcome prediction App for patients with posterior circulation large vessel occlusion after mechanical thrombectomy

Postoperative Batch Prediction

This section will handle postoperative batch predictions. Please click on the link to download the form and fill in the corresponding data. After that, click on the Browse files button to upload file for prediction, you can see the prediction of the classifier at the bottom. This page supports batch prediction of the outcome of multiple patients at one time, and can predict the outcome of patients with missing values.

[Download csv file](#)

Upload CSV file for predictions

Drag and drop file here

Limit 200MB per file • CSV

Browse files

Figure 11

2.5.3 Output result

Once the data is imported, the prognosis prediction results will be displayed automatically. The left column of the output table lists the patient IDs, while the right column labeled "Predictions" indicates the probabilities of favorable outcomes for each patient. To download the CSV file containing the results, click on "Download predictions with results," as shown in the image below:

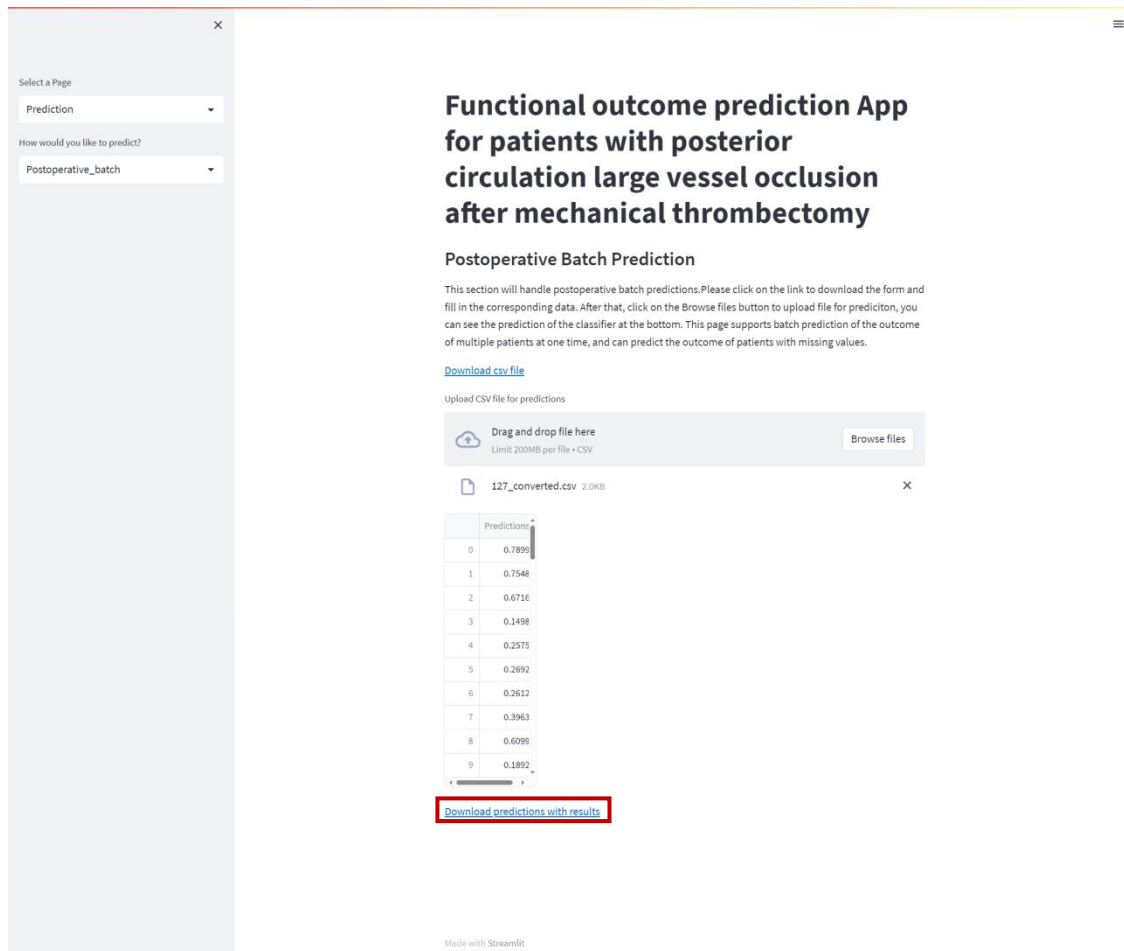


Figure 12

2.5.4 Model update

This prediction system enables users to evaluate model performance and automatically update the model. Users can add an "MRSI" column to the right of the feature column in the downloaded CSV file and input the actual prognosis of the patients. Enter "1" for favorable outcomes and "0" for unfavorable outcomes. After making these updates, simply import the modified CSV file back into the system as described earlier. When users provide more than 10 samples, the system will automatically assess the model's accuracy, recall, precision, F1 score, AUC, Brier score, and other performance metrics. It will also generate the corresponding ROC curve and calibration plot, as shown in the image below:

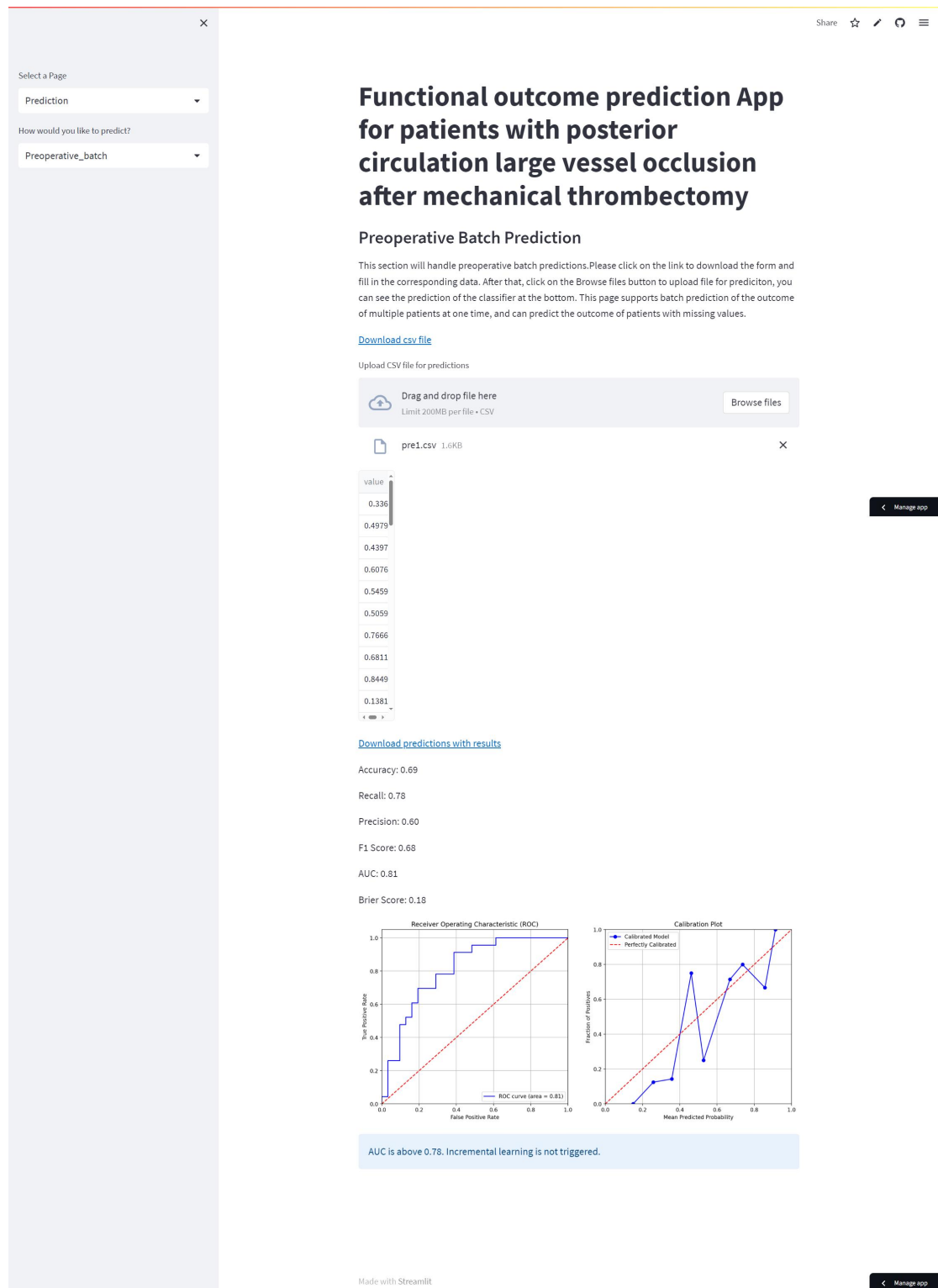


Figure 13

When the sample size added by the user is greater than 10 and the AUC of the model on that batch of users is lower than the set threshold, the system will automatically update the model based on the data provided by the user.

Select a Page

Prediction

How would you like to predict?

Preoperative_batch

Functional outcome prediction App for patients with posterior circulation large vessel occlusion after mechanical thrombectomy

Preoperative Batch Prediction

This section will handle preoperative batch predictions. Please click on the link to download the form and fill in the corresponding data. After that, click on the Browse files button to upload file for prediction, you can see the prediction of the classifier at the bottom. This page supports batch prediction of the outcome of multiple patients at one time, and can predict the outcome of patients with missing values.

[Download csv file](#)

Upload CSV file for predictions

Drag and drop file here

Limit 200MB per file • CSV

Browse files

pre22.csv 395.0B

value

0.336

0.4979

0.4397

0.6076

0.5459

0.5059

0.7666

0.6811

0.8449

0.1381

[Download predictions with results](#)

Accuracy: 0.73

Recall: 0.71

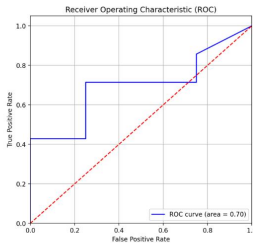
Precision: 0.83

F1 Score: 0.77

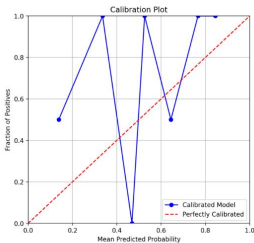
AUC: 0.70

Brier Score: 0.24

Receiver Operating Characteristic (ROC)



Calibration Plot



AUC is below 0.78. Starting incremental learning.

New tree added and weights updated dynamically!

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