Lab: Introduction to Watson OpenScale

Introduction

Businesses today are increasingly certain that AI will be a driving force in the evolution of their industries over the next few years. Yet for every successful AI project, there are many that fail to reach widespread adoption in the business and achieve their expected outcomes. This is partly because the mechanics of AI deployment can be complex, and there are still gaps in skills and tooling that can make it difficult for data science, IT operations, and business teams to work in lockstep. But beyond the operational challenges, there are also much more profound issues of trust and transparency that businesses need to address before they can truly turn AI into a business advantage.

Knowledge workers must be able to trust AI and explain the decisions it helps make before they will incorporate it in their business processes. If AI is a black box that simply takes in data and produces obscure, unexplainable outcomes, then there is no way for the business to judge whether these systems are producing fair, accurate outcomes, or have confidence in AI's ability to augment decision-making. Equally, the business will not be able to explain outcomes to customers, auditors, or compliance teams.

IBM Watson OpenScale is an open platform that helps remove barriers to enterprise-scale AI. Watson OpenScale enables the enterprise to:

- Measure performance of production AI and its impact on business goals
- Track actionable metrics in a single console
- Explain AI outcomes
- Detect and mitigate harmful bias to improve outcomes
- Accept feedback to compute accuracy measures
- Accelerate the integration of AI into existing business applications.

Objectives

The goal of this lab is to familiarize the user with the features of Watson OpenScale. After completing this lab, you will understand how to:

1. Import a machine learning model
2. Deploy the model
3. Provision Watson OpenScale
4. Configure the payload logging database and Machine Learning provider
5. Score Data
6. Prepare Deployed Model for Monitoring
7. Configure Payload Logging
8. Configure Quality
9. Configure Fairness
10. Configure Drift
11. Submit Feedback and View Quality Metrics

12. Score Data and View Fairness Metrics
13. Explain a Transaction.

Lab Use Case

Traditional lenders are under pressure to expand their digital portfolio of financial services to a larger and more diverse audience, which requires a new approach to credit risk modeling. Their data science teams currently rely on standard modeling techniques - like decision trees and logistic regression - which work well for moderate datasets and make recommendations that can be easily explained. This satisfies regulatory requirements that credit lending decisions must be transparent and explainable.

To provide credit access to a wider and riskier population, applicant credit histories must expand beyond traditional credit, like mortgages and car loans, to alternate credit sources like utility and mobile phone plan payment histories, plus education and job titles. These new data sources offer promise, but also introduce risk by increasing the likelihood of unexpected correlations which introduce bias based on an applicant's age, gender, or other personal traits.

The data science techniques most suited to these diverse datasets, such as gradient boosted trees and neural networks, can generate highly accurate risk models, but at a cost. Such "black box" models generate opaque predictions that must somehow become transparent, to ensure regulatory approval such as Article 22 of the General Data Protection Regulation (GDPR), or the federal Fair Credit Reporting Act (FCRA) managed by the Consumer Financial Protection Bureau.

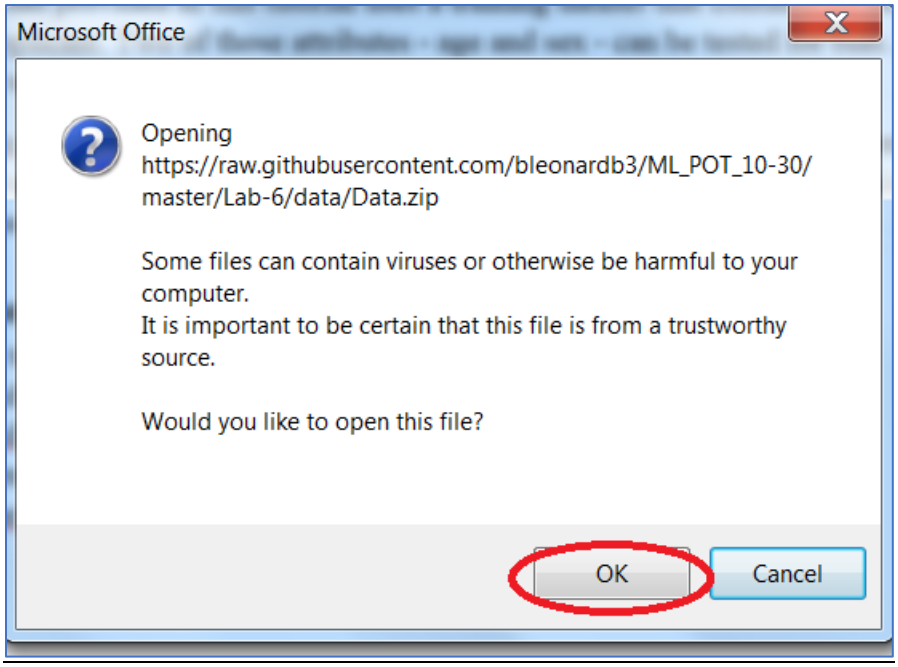
The credit risk model provided in this tutorial uses a training dataset that contains 20 attributes about each loan applicant. Two of those attributes - age and sex - can be tested for bias. For this tutorial, the focus will be on bias against sex and age.

Watson OpenScale will monitor the deployed model's propensity for a favorable outcome ("No Risk") for one group (the Reference Group) over another (the Monitored Group). In this tutorial, the Monitored Group for sex is `female`, while the Monitored Group for age is `19 to 25`.

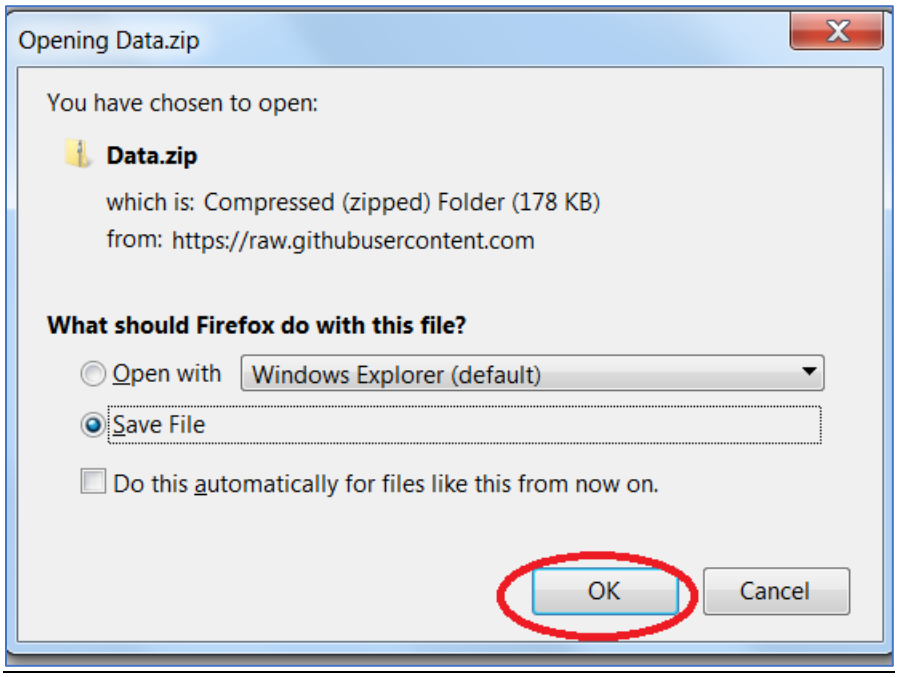
Download the Lab Files

1. Click here to download the Data.zip file. Four files are contained in the zip file.
    1. credit_feedback_data.csv
    2. credit_payload_data.json
    3. german_credit_data_biased_training.csv
    4. scoring.json

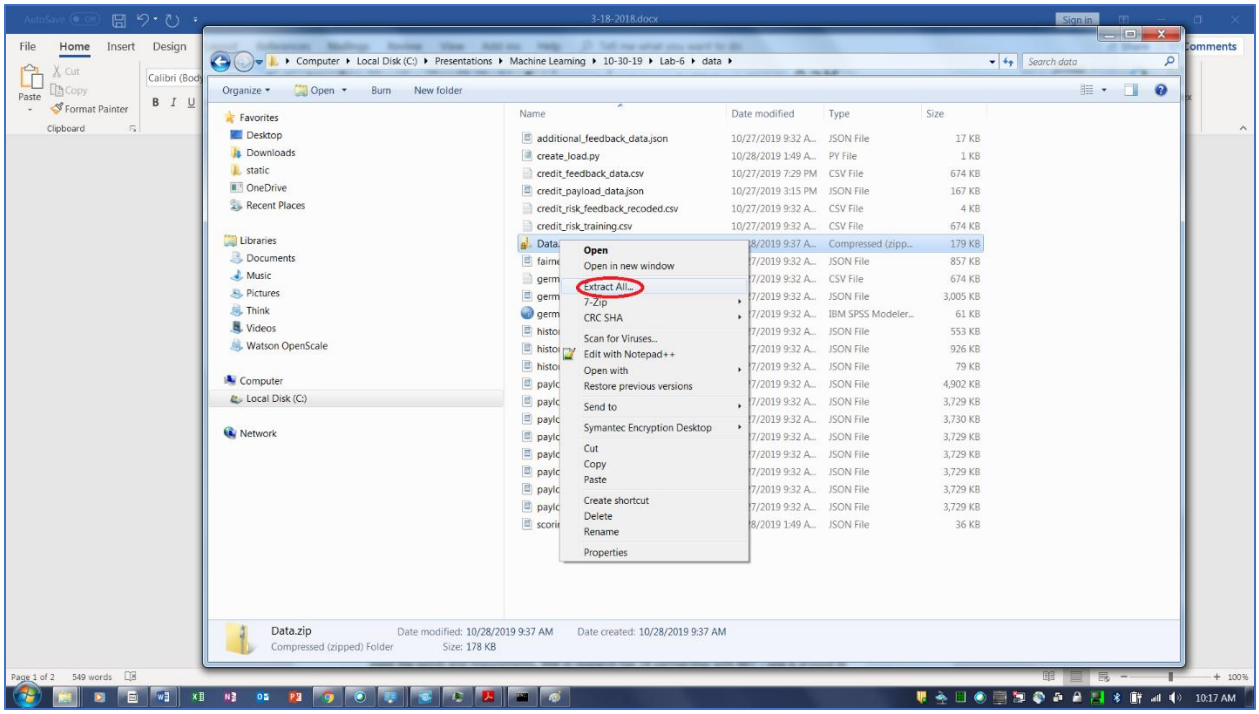
2. Click **OK**. Note your browser may not prompt this message.



3. Click **OK**.

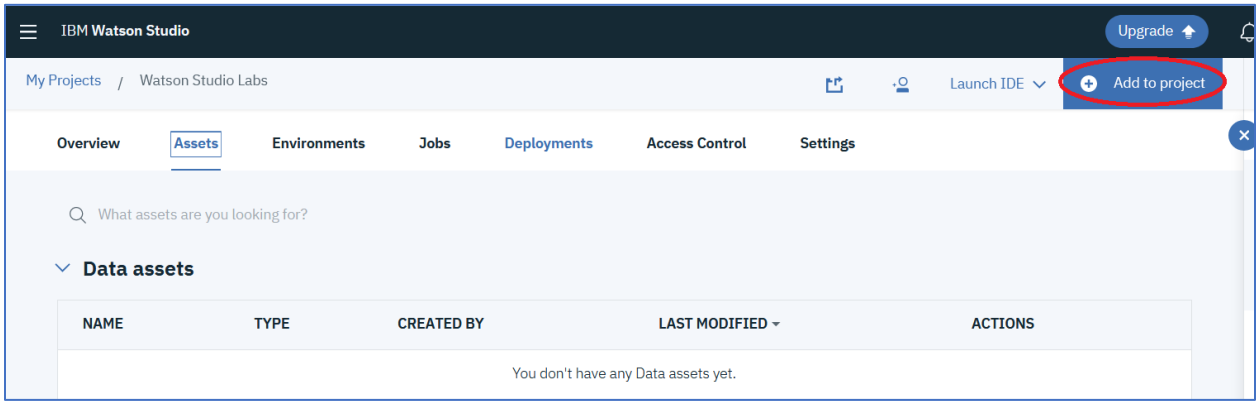


4. Navigate to the folder where the file is saved. Select the Data.zip file, right-click, and click **Extract All**.

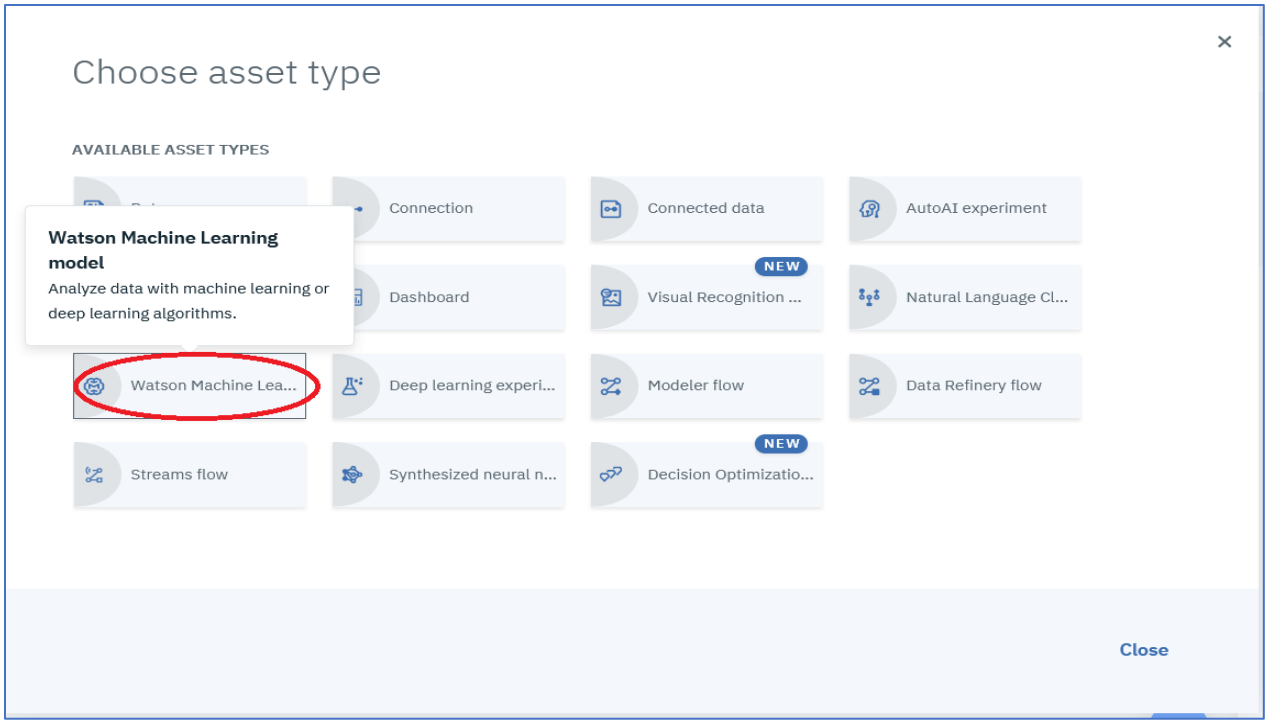


Import the Credit Risk Model

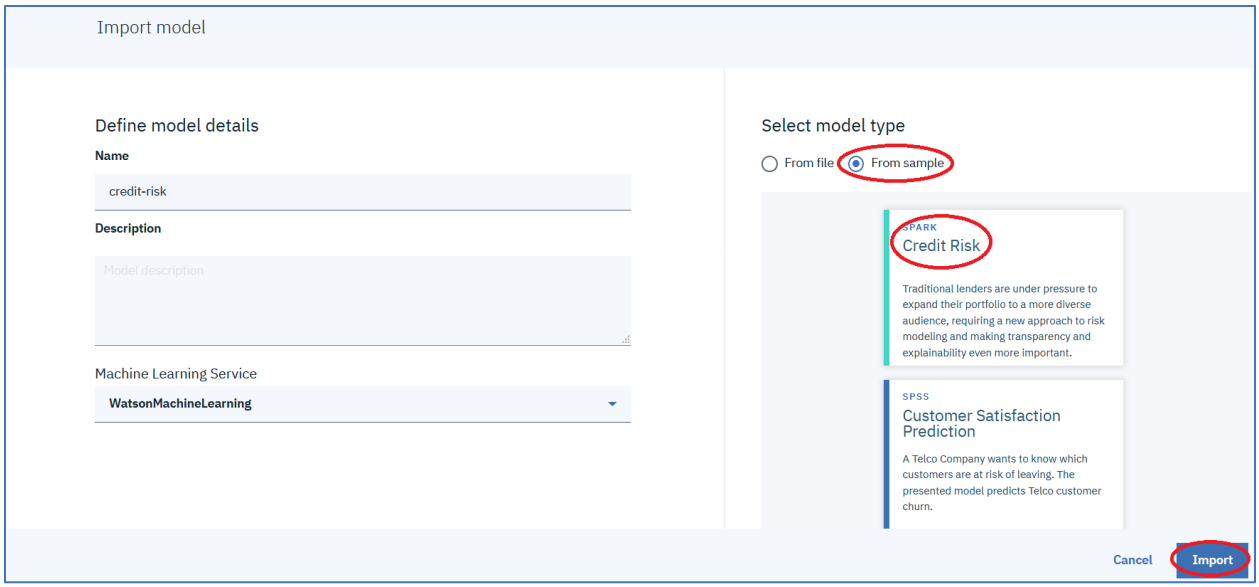
1. From the Watson Studio project, click on **Add to project**.



2. Click on **Watson Machine Learning**.

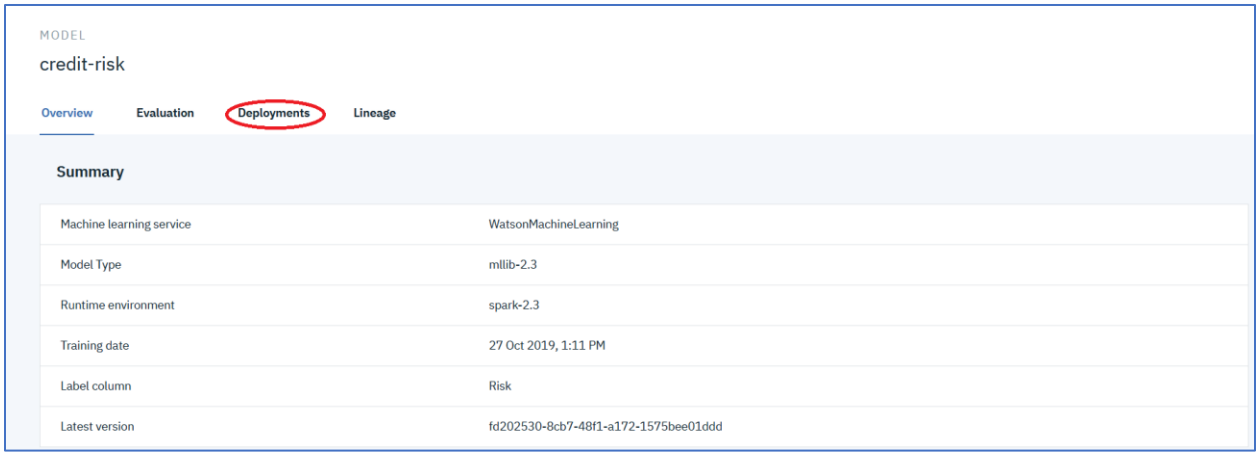


3. From the **Import model** page, click on **From sample** for the **Select model type**, click on **Credit Risk**, and then click on **Import**.

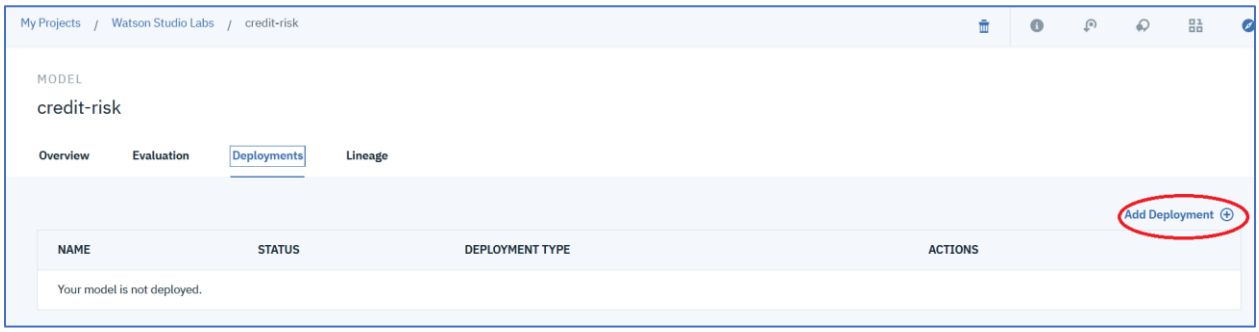


Deploy the Credit Risk Model

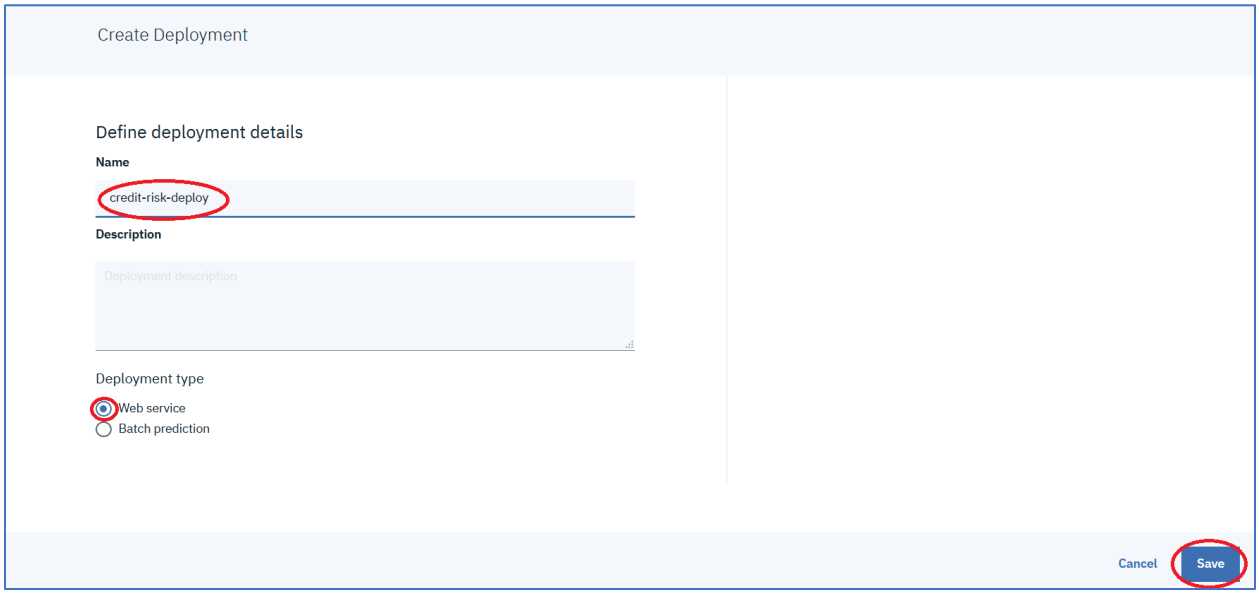
1. From the **Model** page, click on the **Deployments** tab.



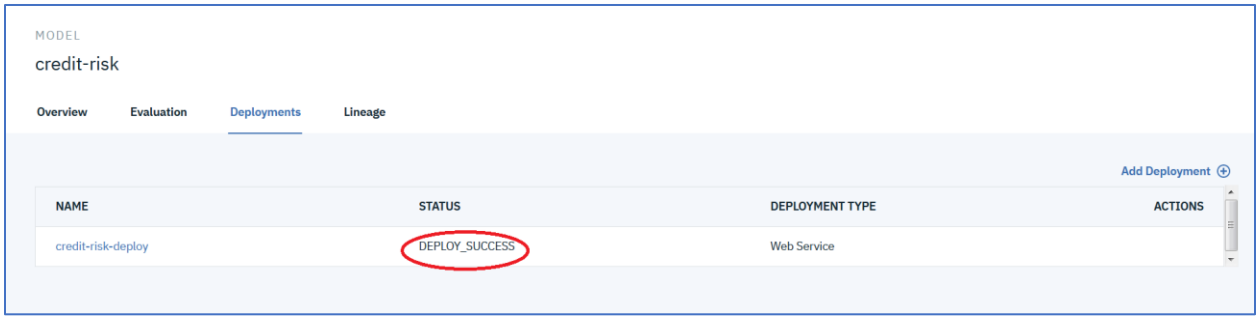
2. Click on **Add Deployments**.



3. From the **Create Deployment** page, type **credit-risk-deploy** for the **Name**, select **Web service** for the Deployment type, and click on **Save**.

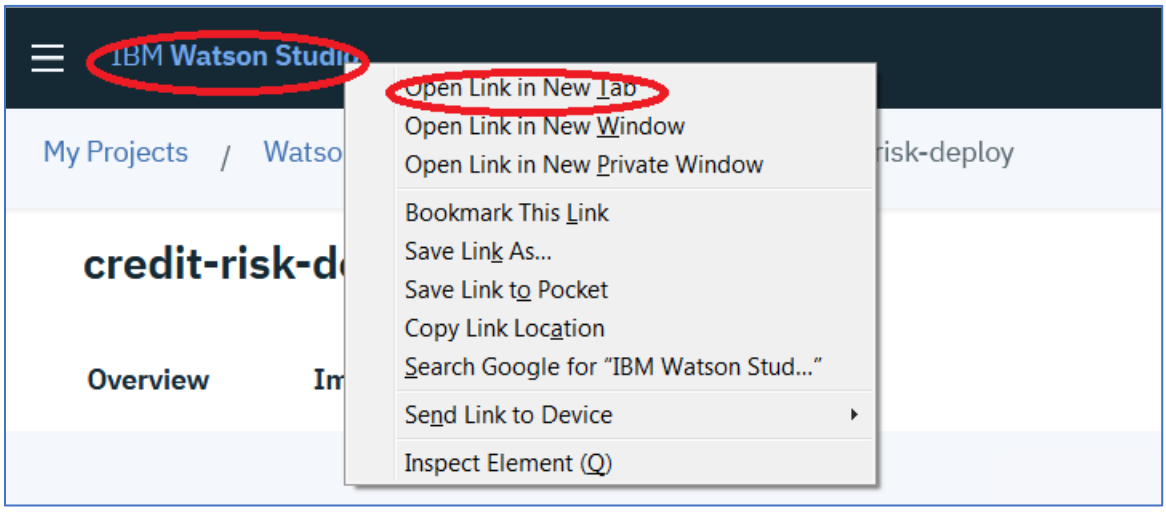


4. The deployment status should go from **INITIALIZING** to **DEPLOY SUCCESS**. If the status doesn't change after a minute or so, refresh the browser.



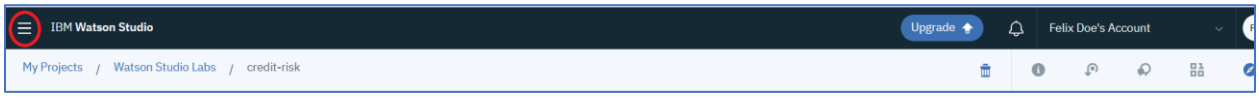
Provision Watson OpenScale.

1. Right-click on the **IBM Watson Studio** label and click on **Open link in New Tab**.

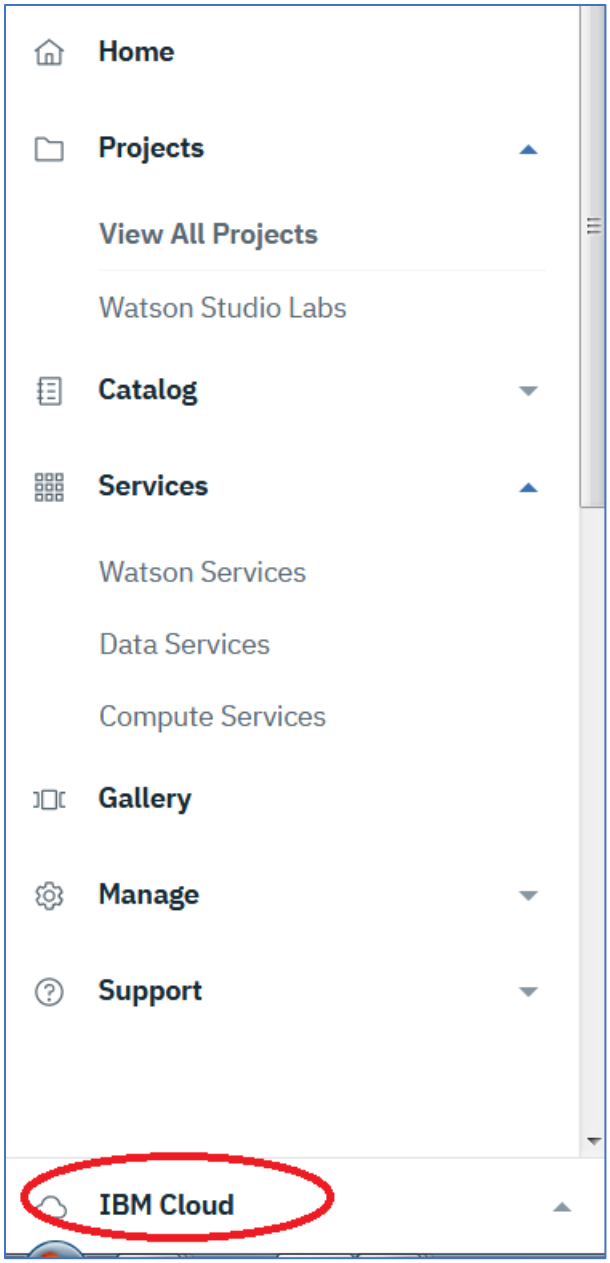


2. Click on the new **Watson Studio** browser tab.

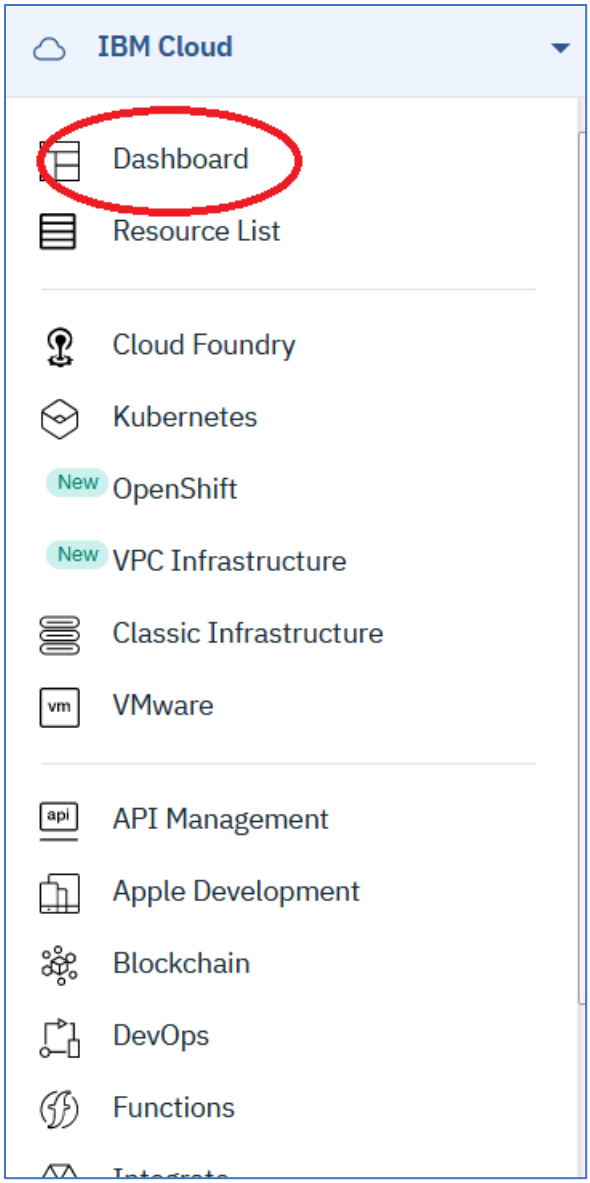
3. Click on the hamburger icon ☰ in the top left corner.



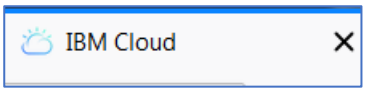
4. Click on **IBM Cloud**.



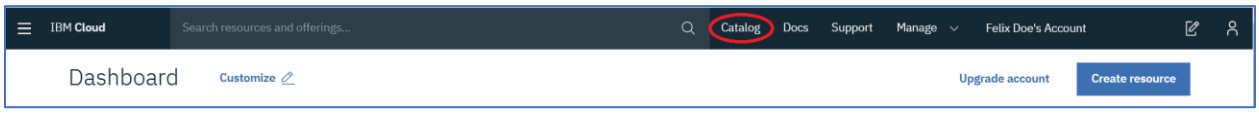
5. Click on **Dashboard**.



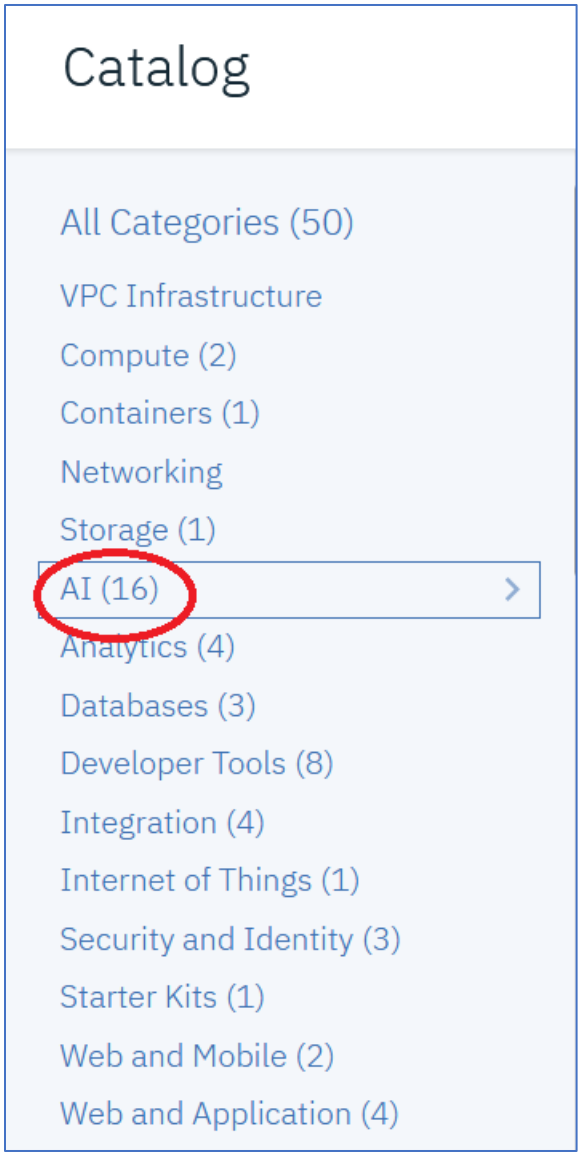
6. Note that the browser tab has been renamed to IBM Cloud.



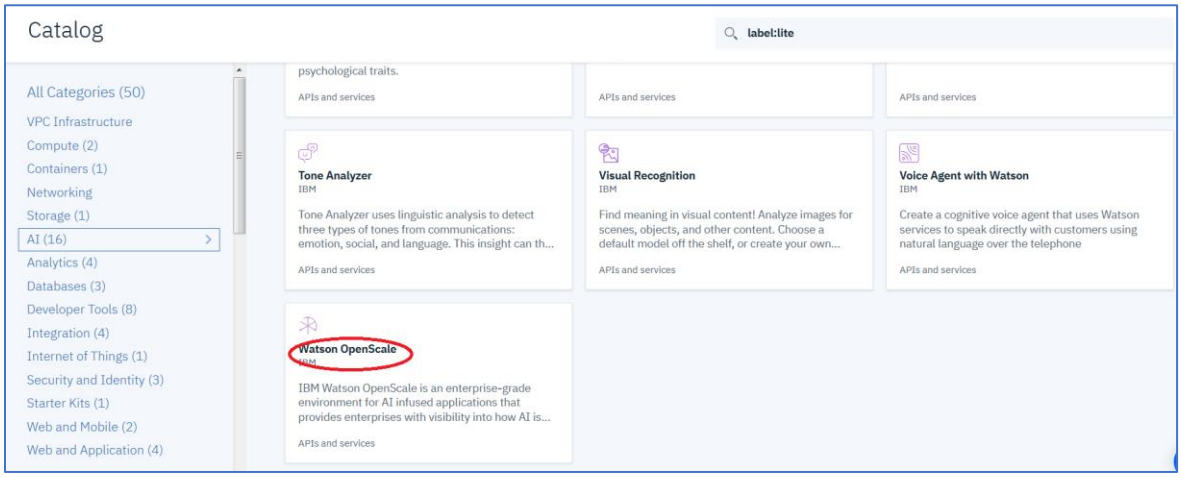
7. Click on **Catalog**



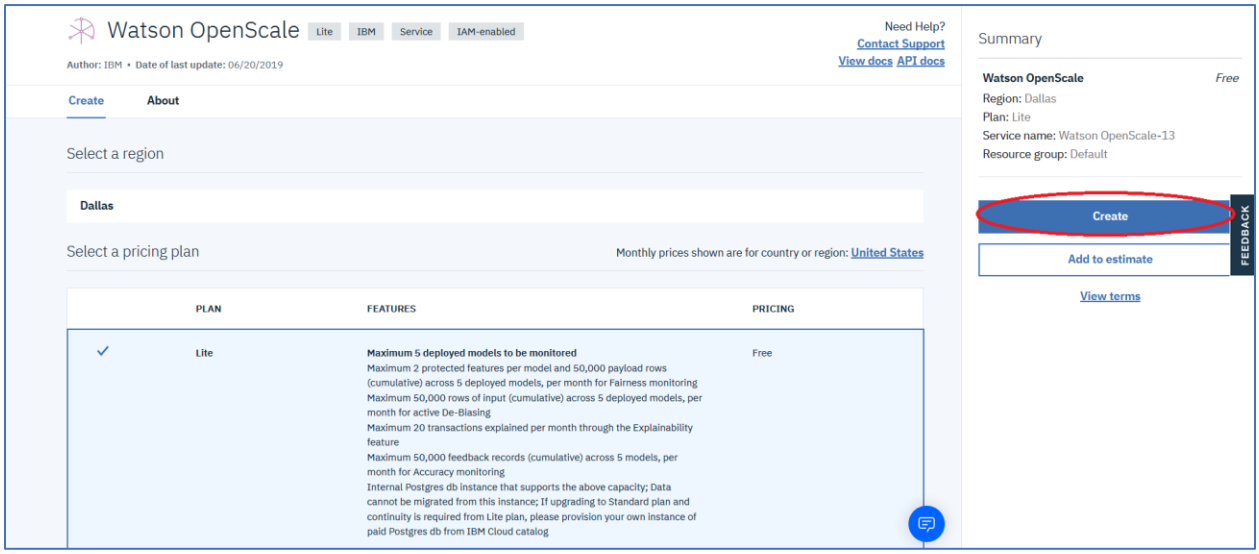
8. Click on **AI**



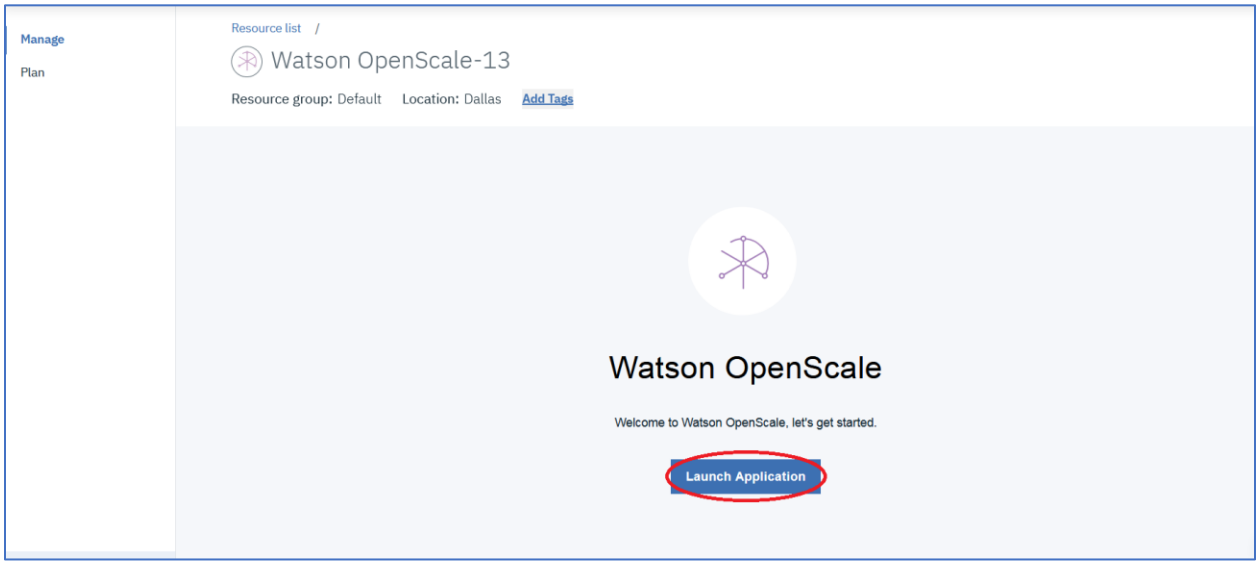
9. Scroll down and click on **Watson OpenScale**.



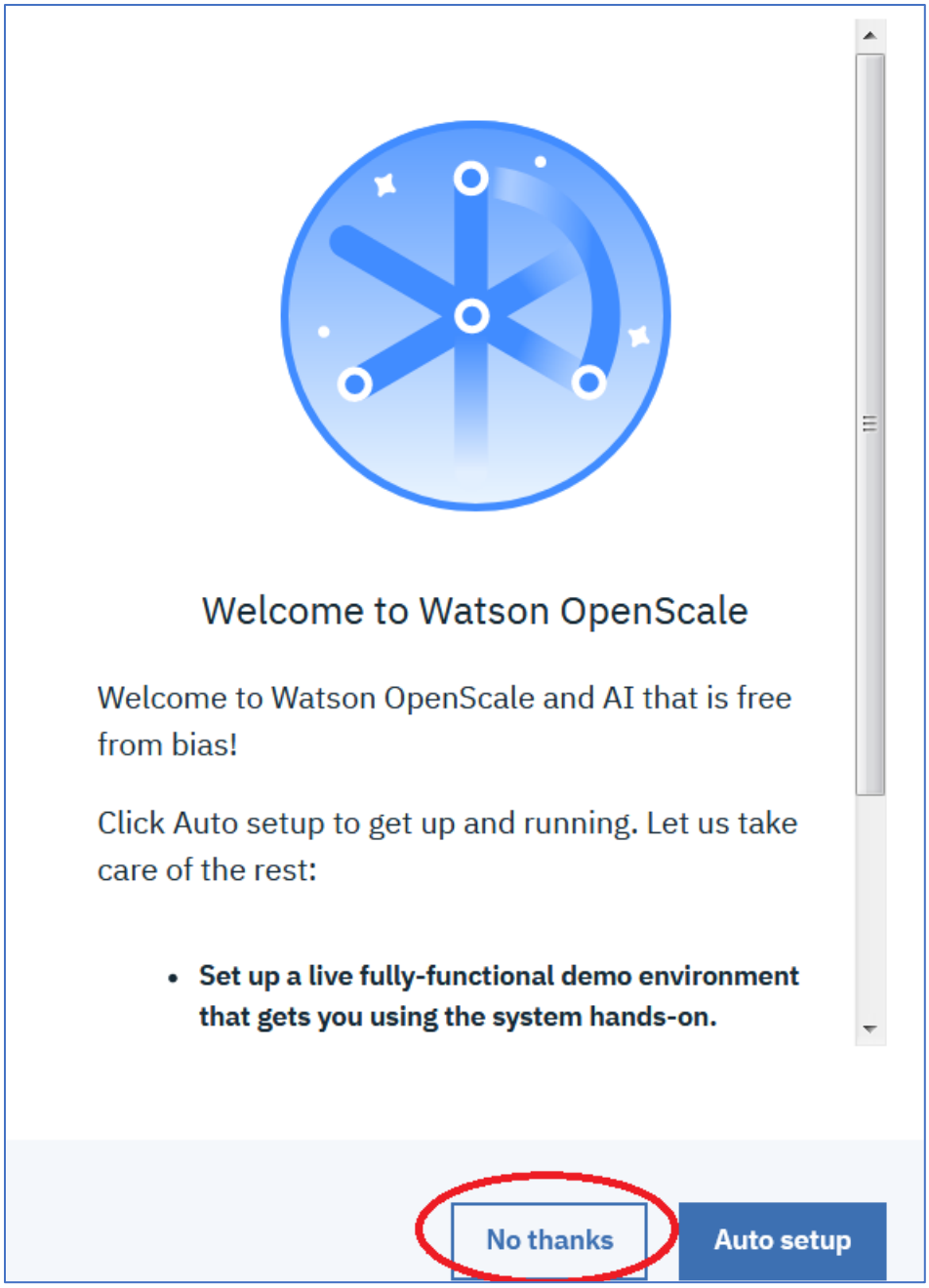
10. Click on **Create**.



11. Click on **Launch Application**.

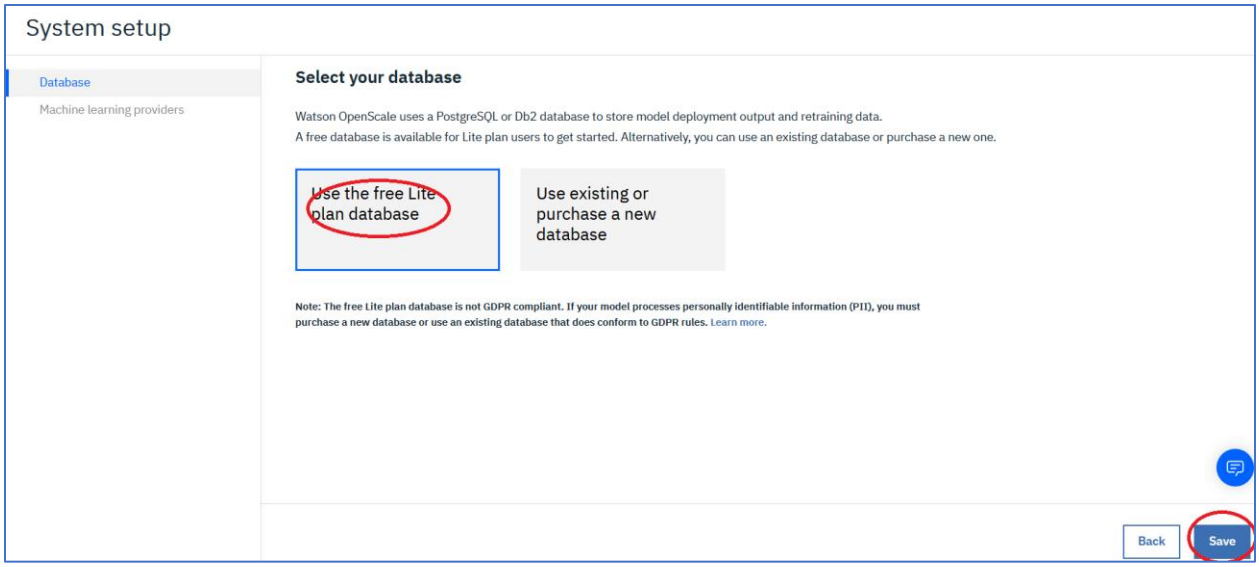


12. Make sure to click on **No Thanks**.

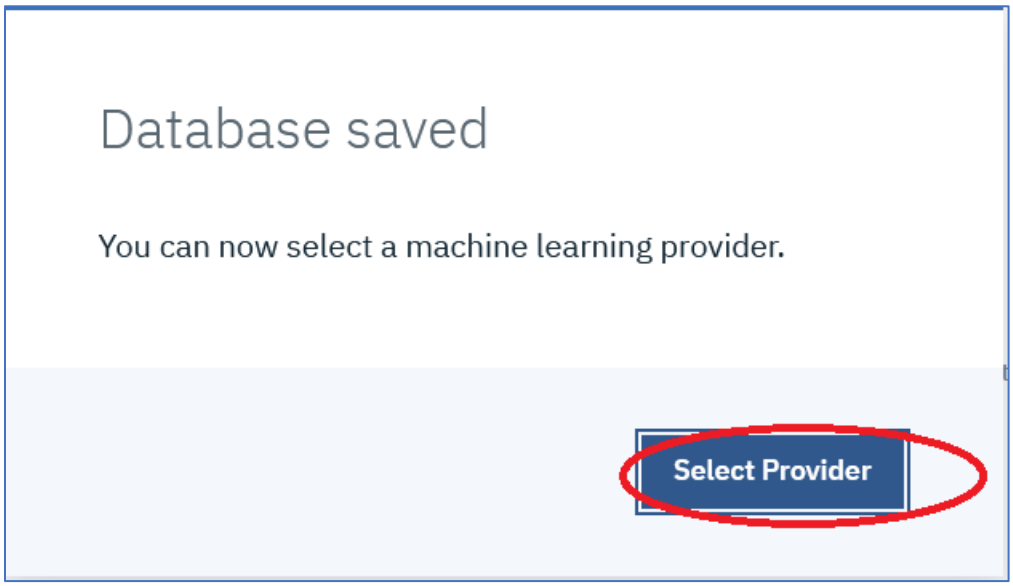


Setup System

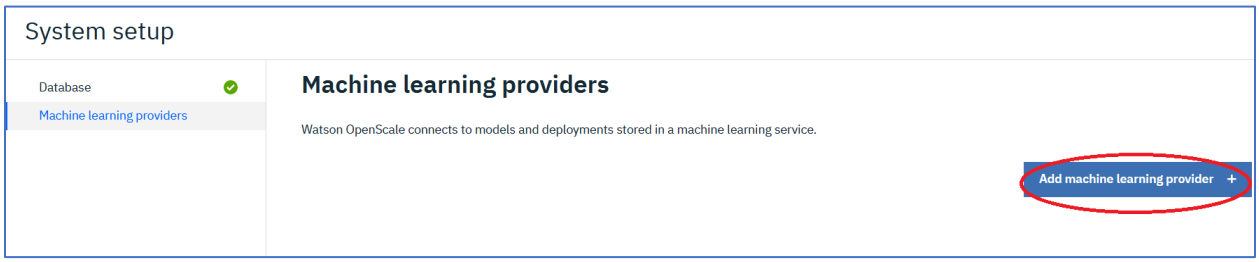
1. In the system setup, we need to set up a database to collect the payload logging data. We also need to specify which deployed model will be monitored.
2. Click on **Use the free Lite plan database** for **Select your database** and click on **Save.**



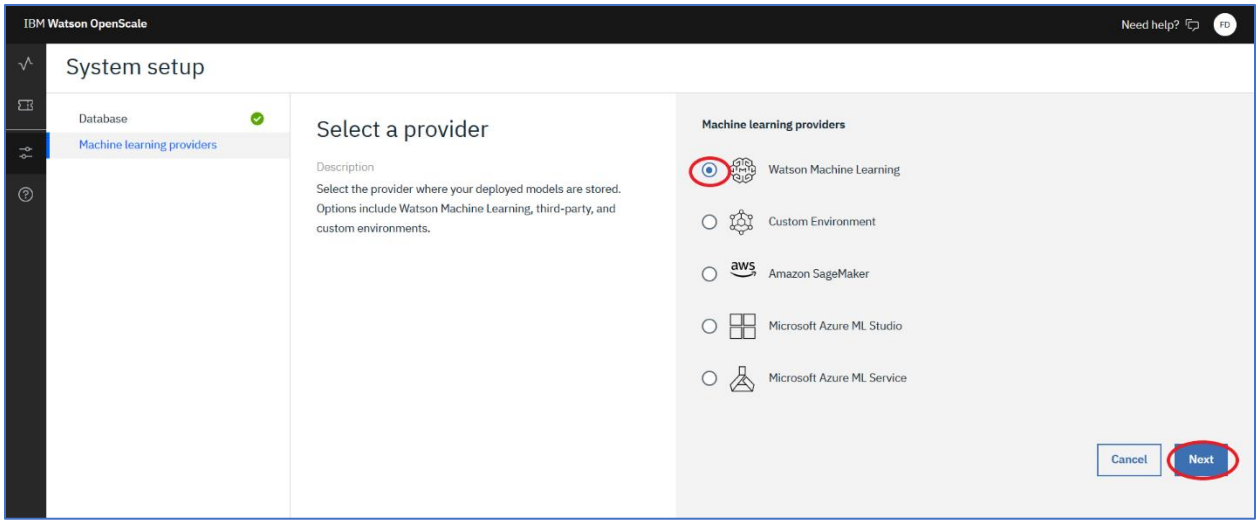
3. Click on **Select Provider**.



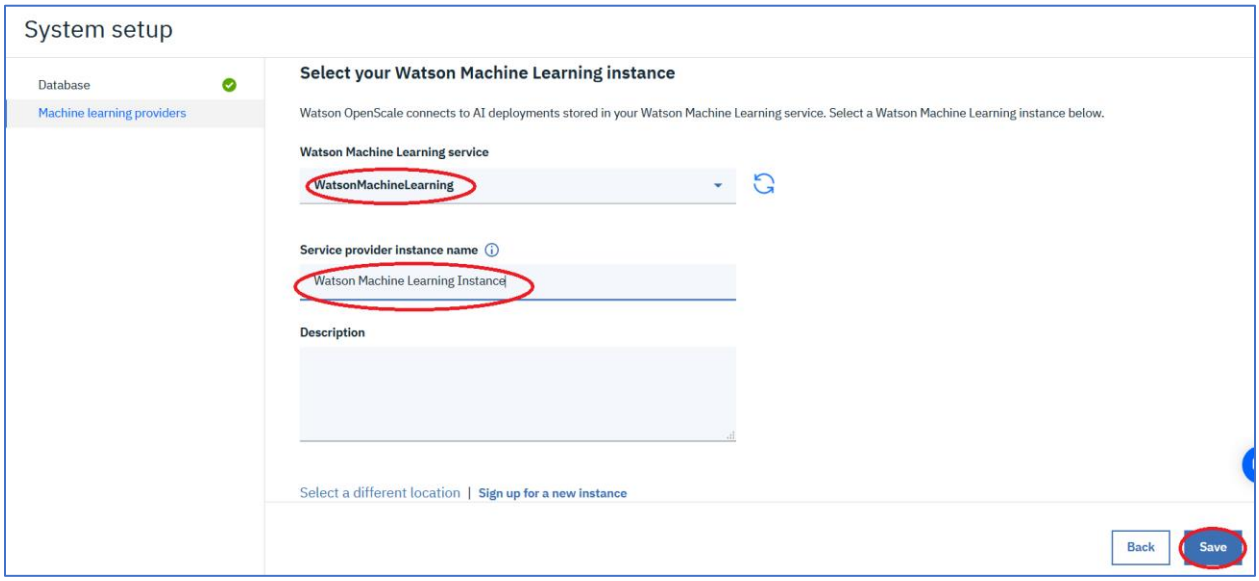
4. Click on **Add machine learning provider**.



5. Click on **Watson Machine Learning** and click on **Next**.



6. Click on **WatsonMachineLearning** for the **Watson Machine Learning** service, type in **Watson Machine Learning Instance** for the **Service provider instance name**, and then click **Save**.



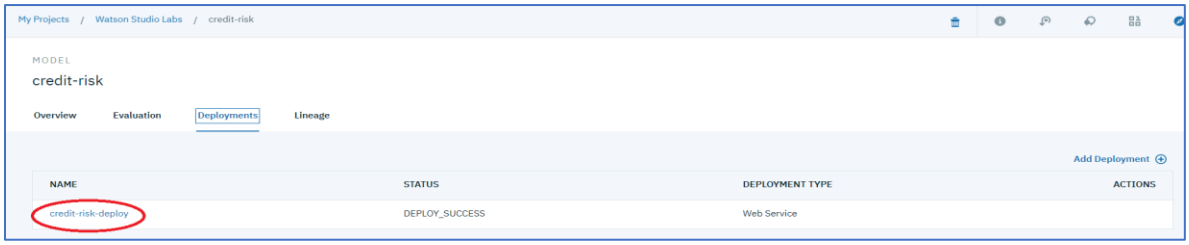
7. Setup is now complete. Do not proceed until you do the scoring step below.

Score Data

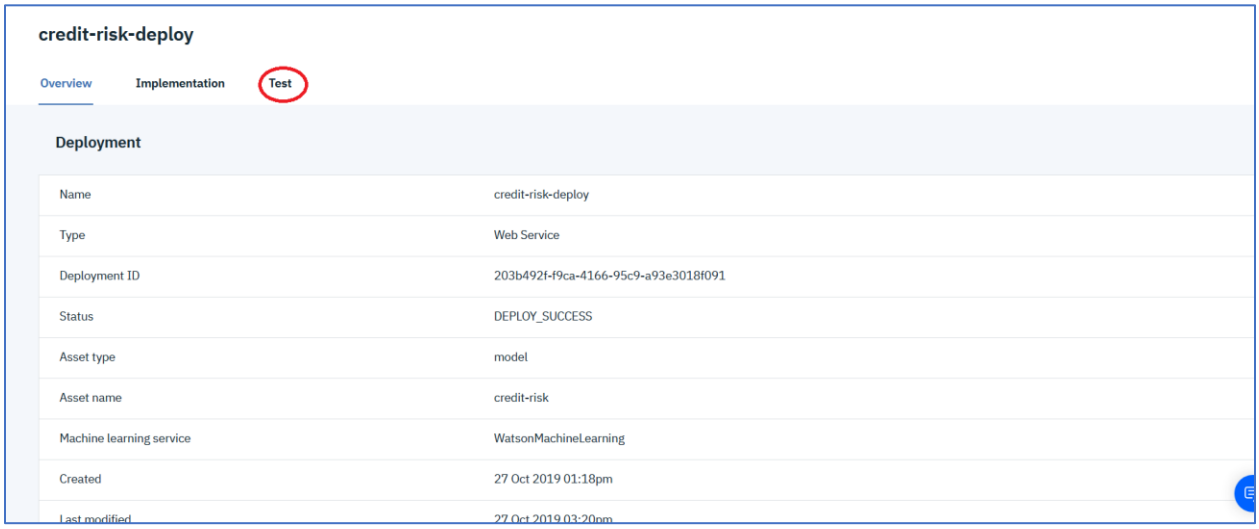
Before proceeding with the monitor configuration, we need to send scoring data to the deployed model in order to generate payload logging data that the monitors can consume. We will use the credit_risk_data.json file as sample data that Watson Studio will submit to the deployed model.

1. Click on the **Watson Studio** Browser tab 

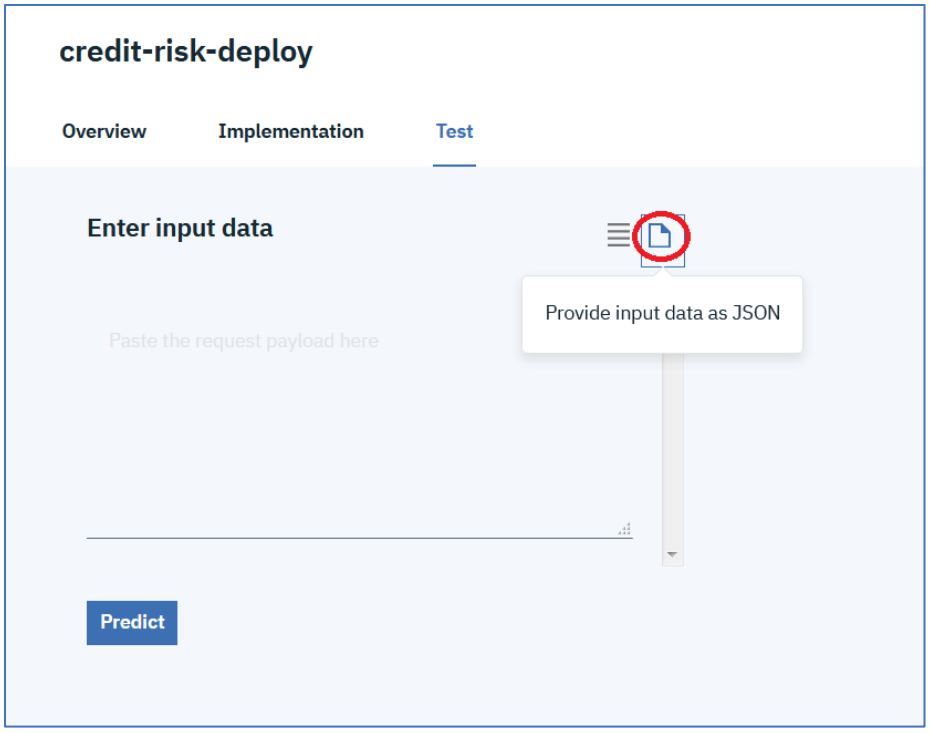
2. You should be back at the **credit-risk Model** page. Click on **credit-risk-deploy**.



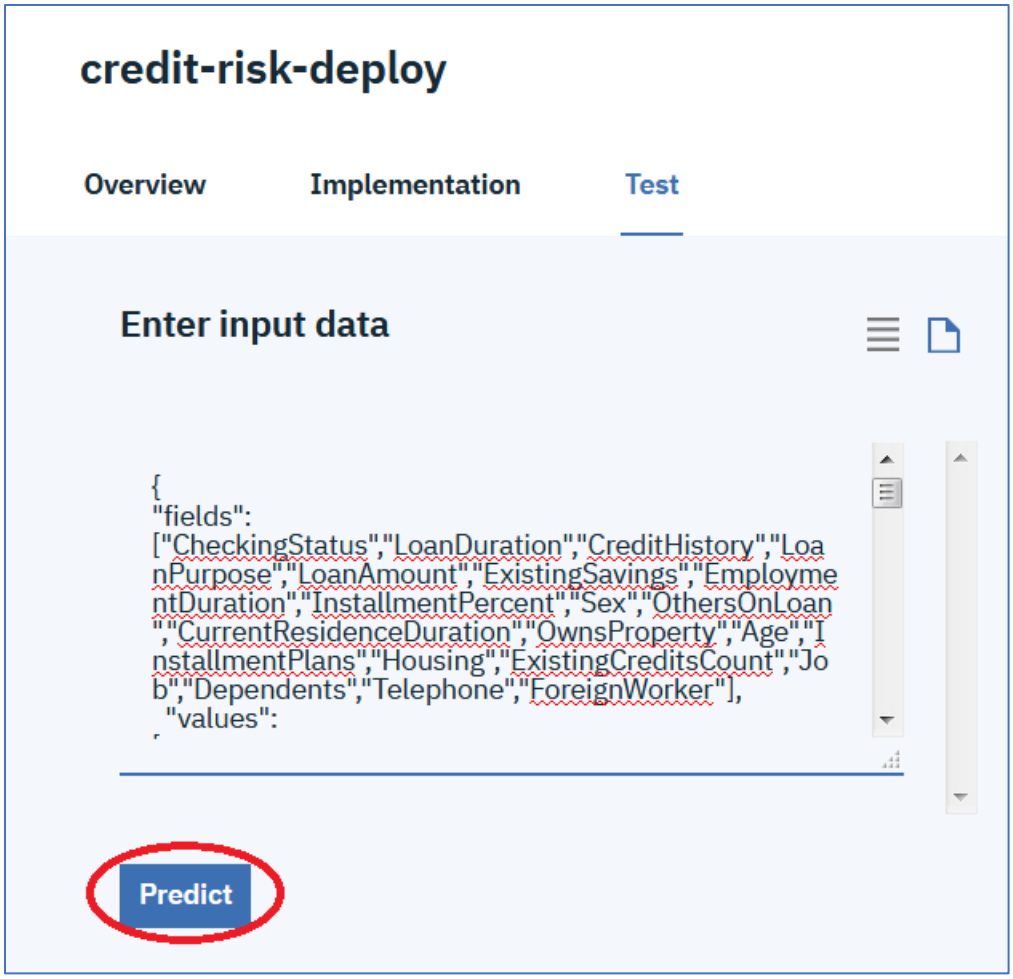
3. Click on the **Test** tab.



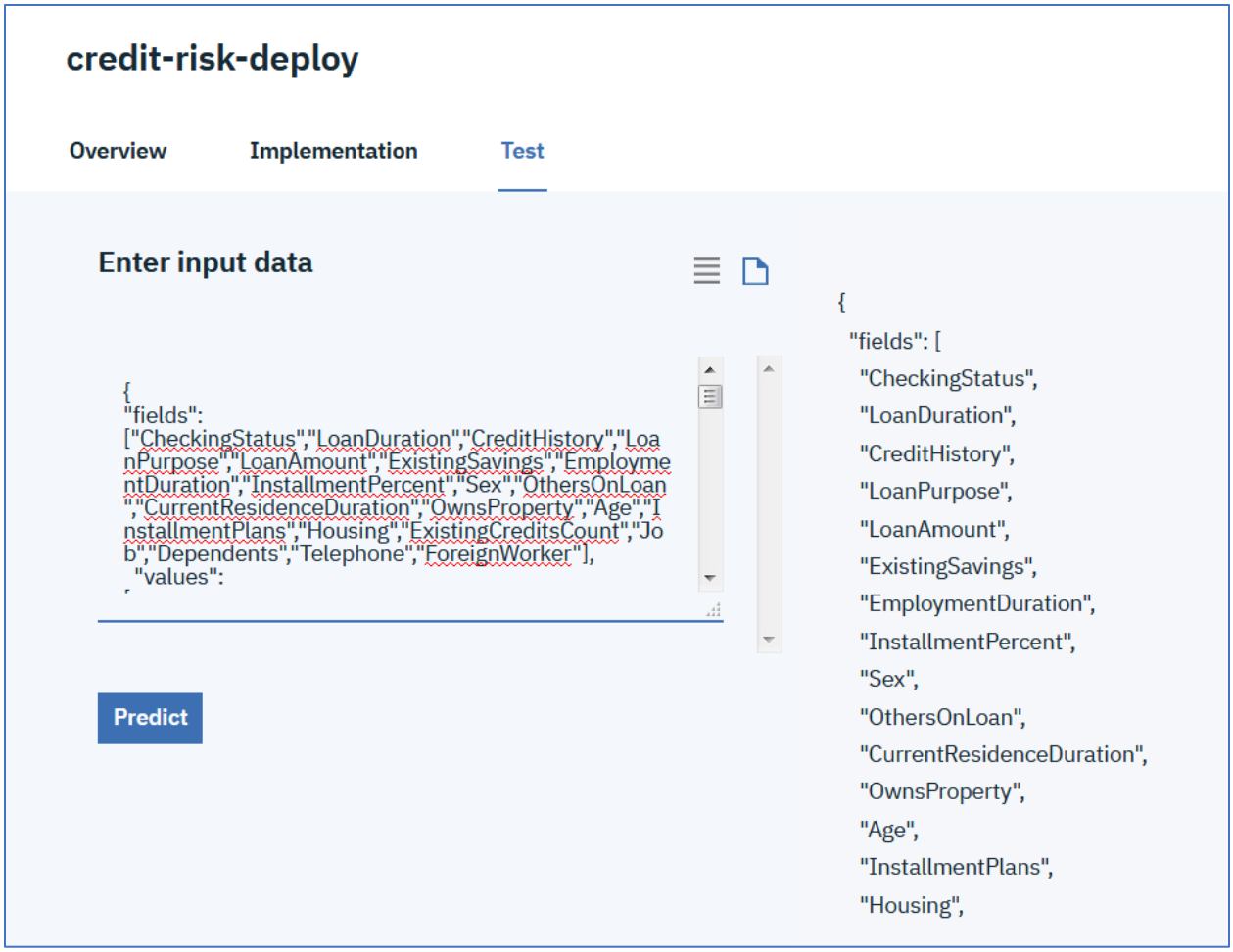
4. Click on the  icon to accept input as JSON.



5. Copy the file contents of **credit_payload_data.json** into the **input data** area and click on **Predict**.



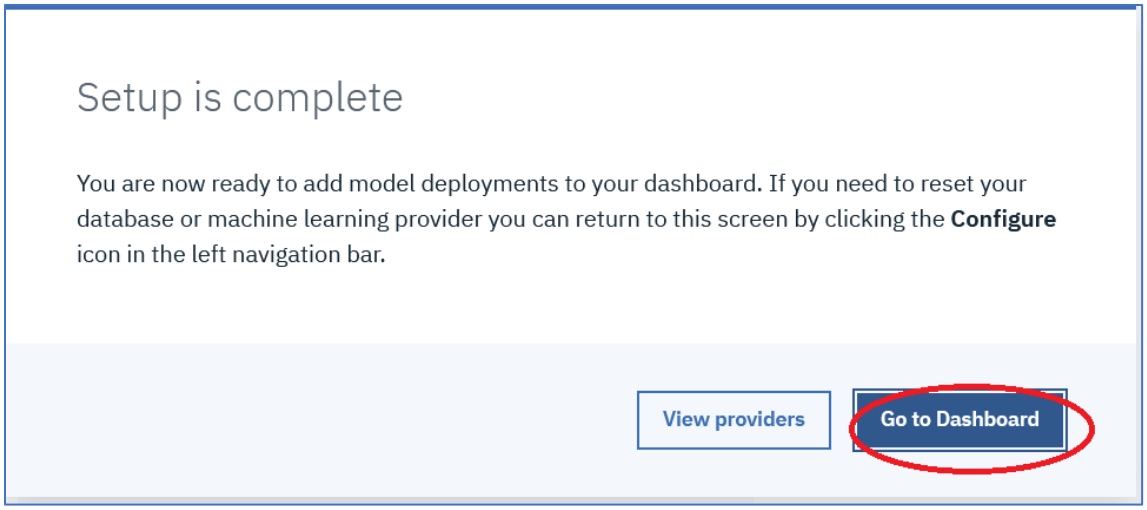
6. The results should appear as below.



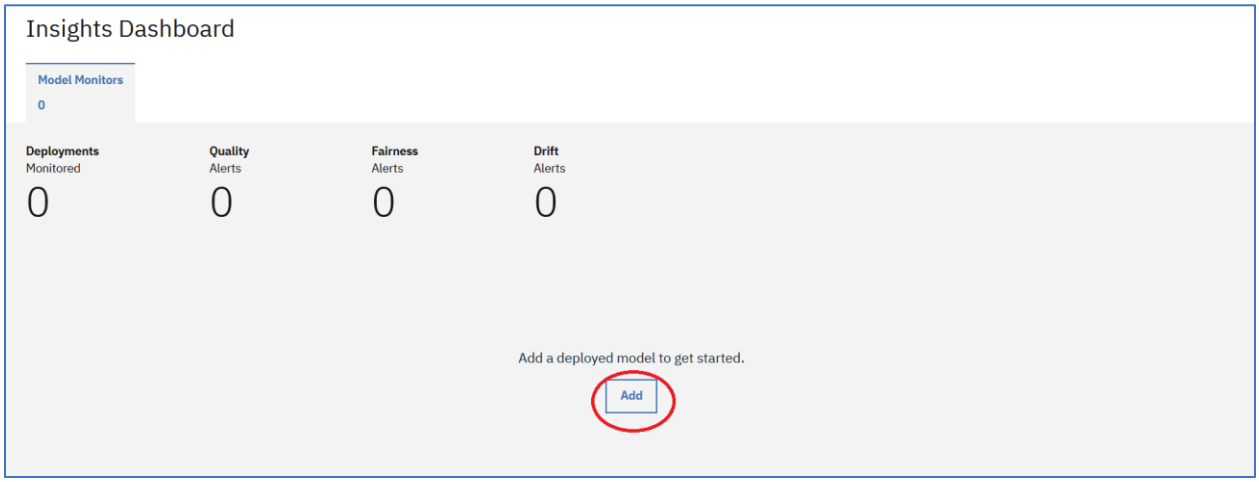
Prepare deployed model for monitoring

1. Switch back to Watson OpenScale by clicking on the Watson OpenScale browser tab.

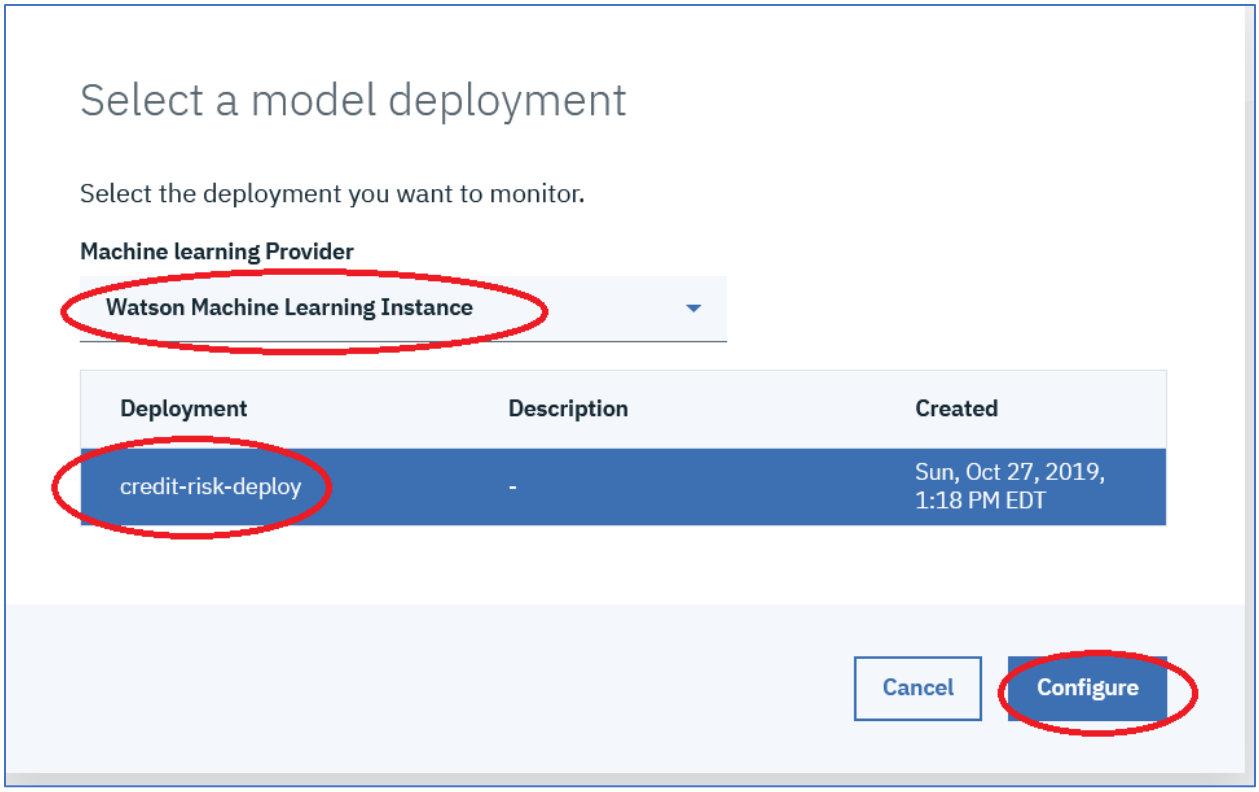

2. Click on **Go to Dashboard**



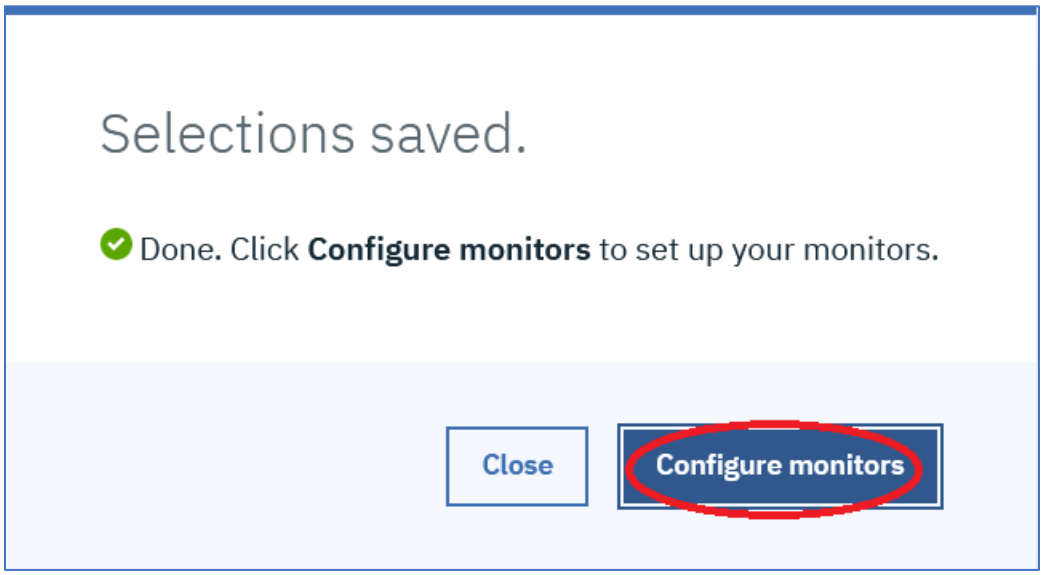
3. Click on **Add**.



4. Click on **Watson Machine Learning Instance** for the **Machine learning Provider**, click on **credit-risk-deploy** for the **Deployment**, and click **Configure**.



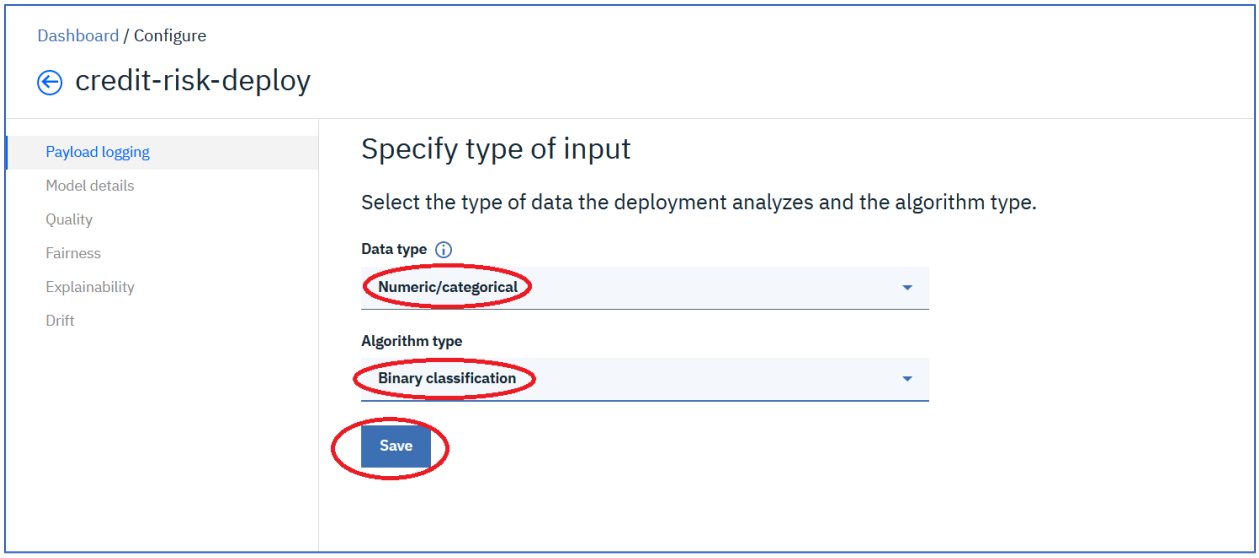
5. Click on **Configure monitors**.



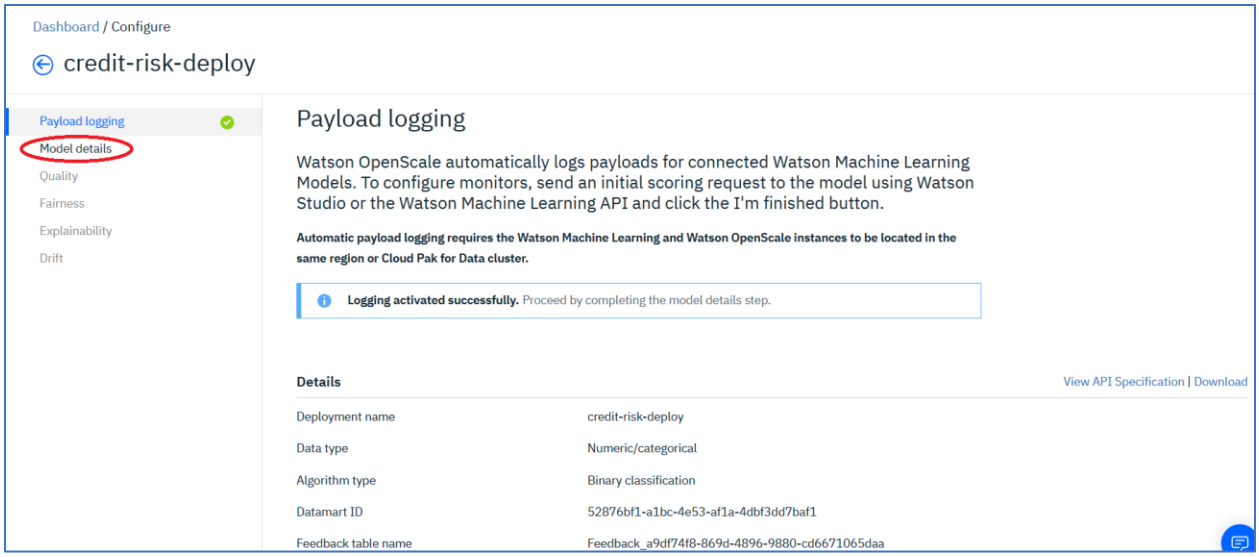
Configure Payload Logging

You must provide information about your model and training data to configure payload logging.

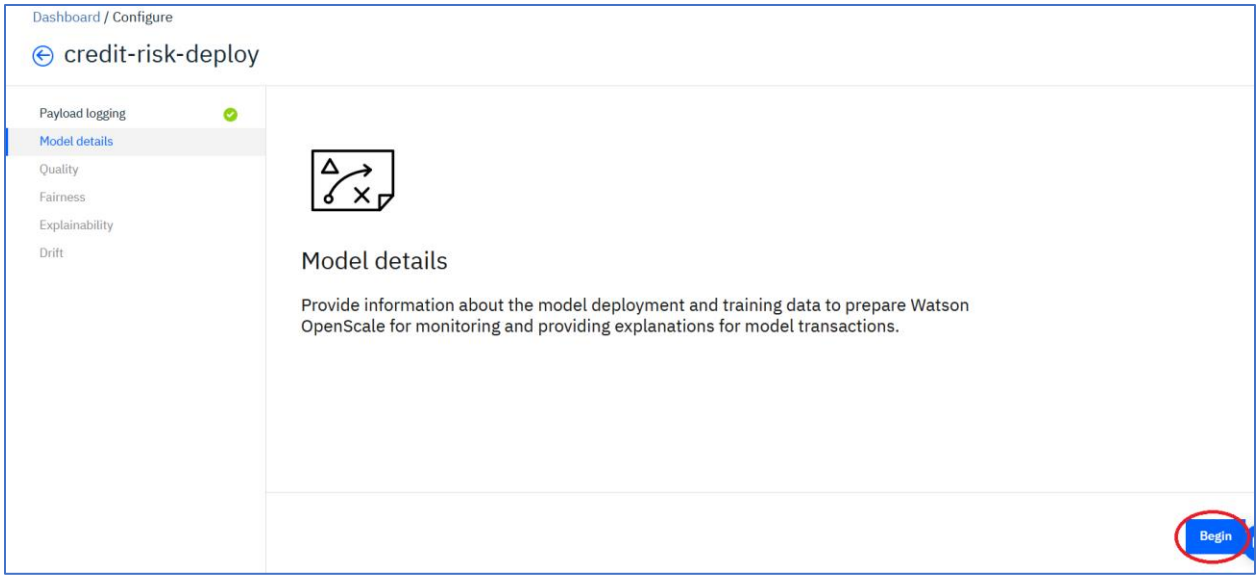
1. Click on **Numeric/categorical** for **Data type**, click on **Binary classification**, and click on **Save**.



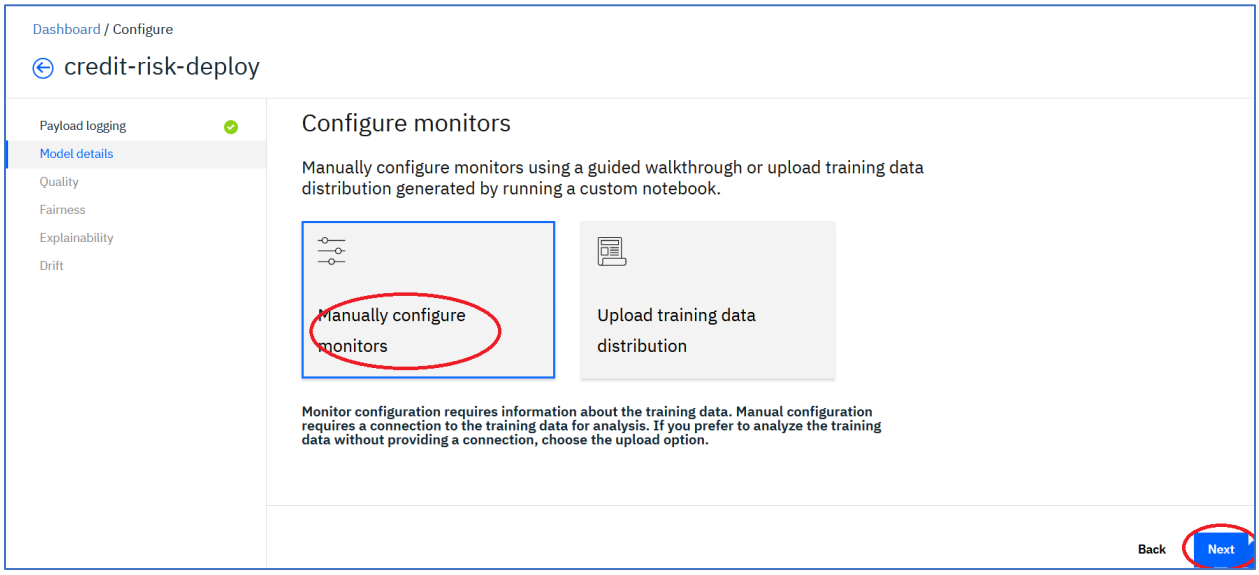
2. Click on **Model details**. Since we already sent scoring requests to the deployed model, the Logging should be activated successfully.



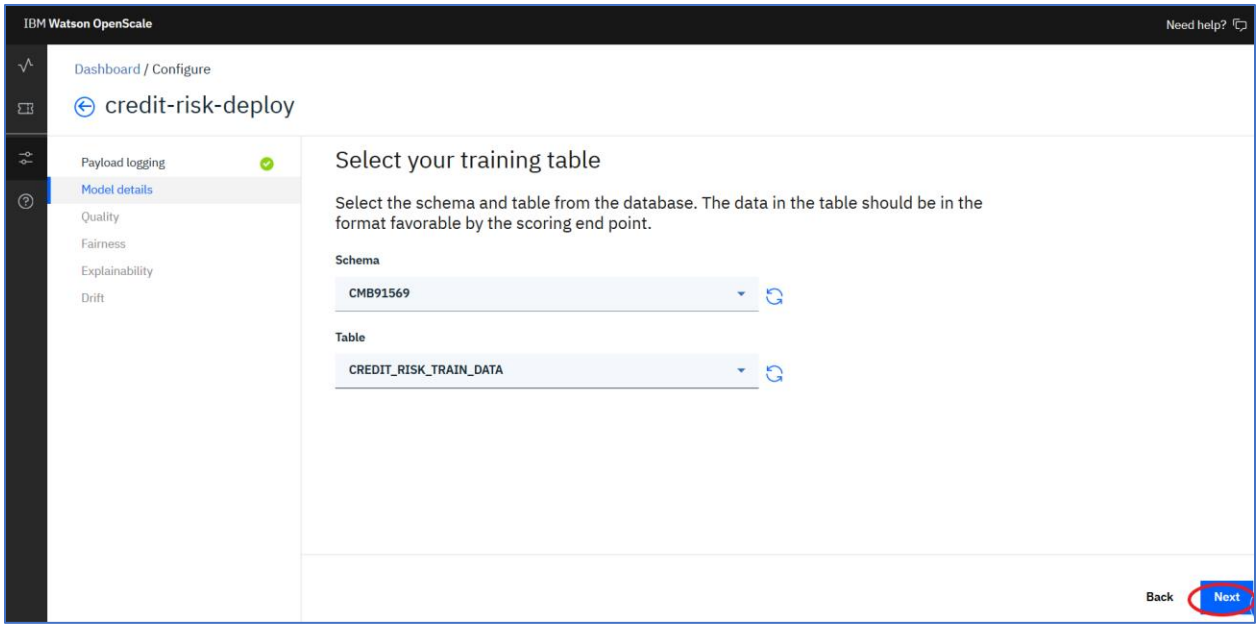
3. We need to provide information about the model deployment and training data to prepare Watson OpenScale for monitoring and providing explanations for model transactions. Click **Begin**.



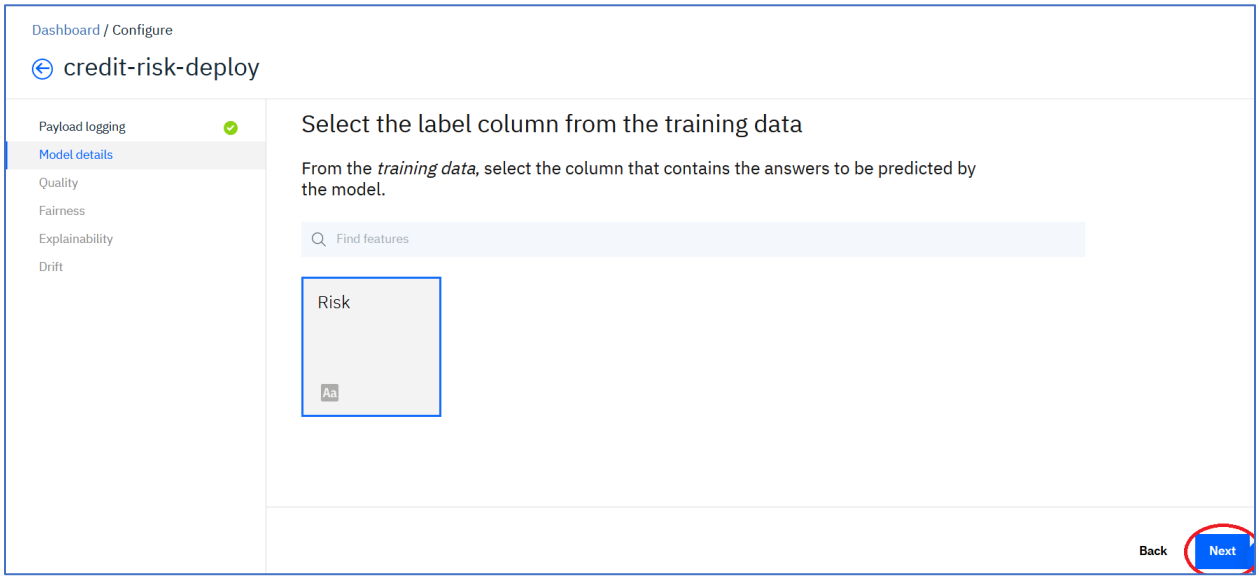
4. Click on **Manually configure monitors** and click **Next**.



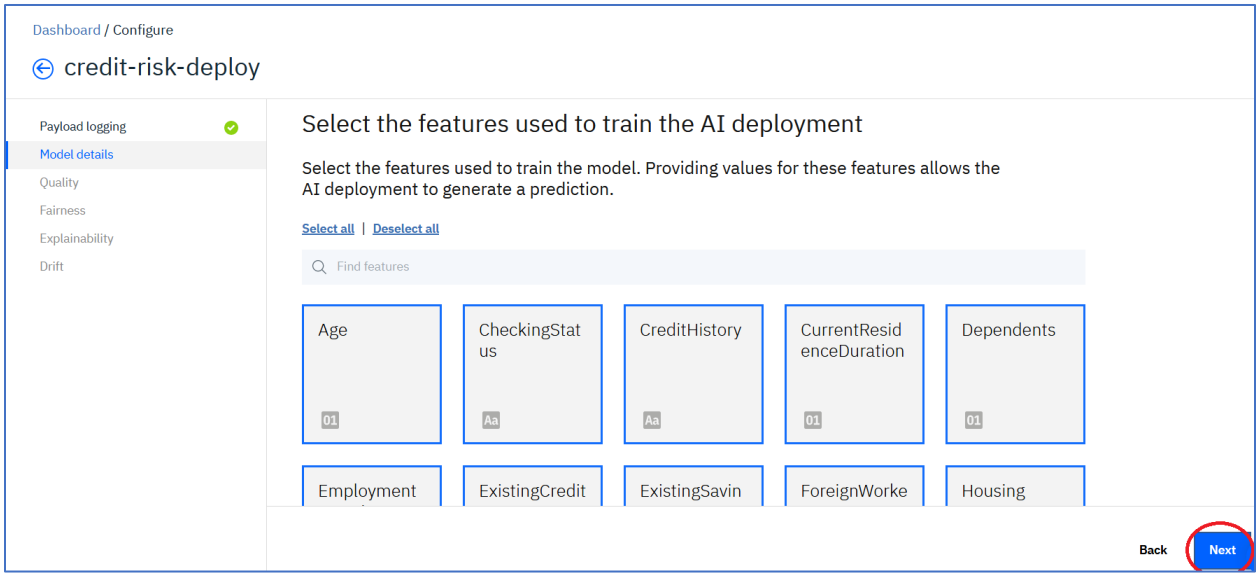
5. Leave the defaults for the Schema and Table then click on **Next**.



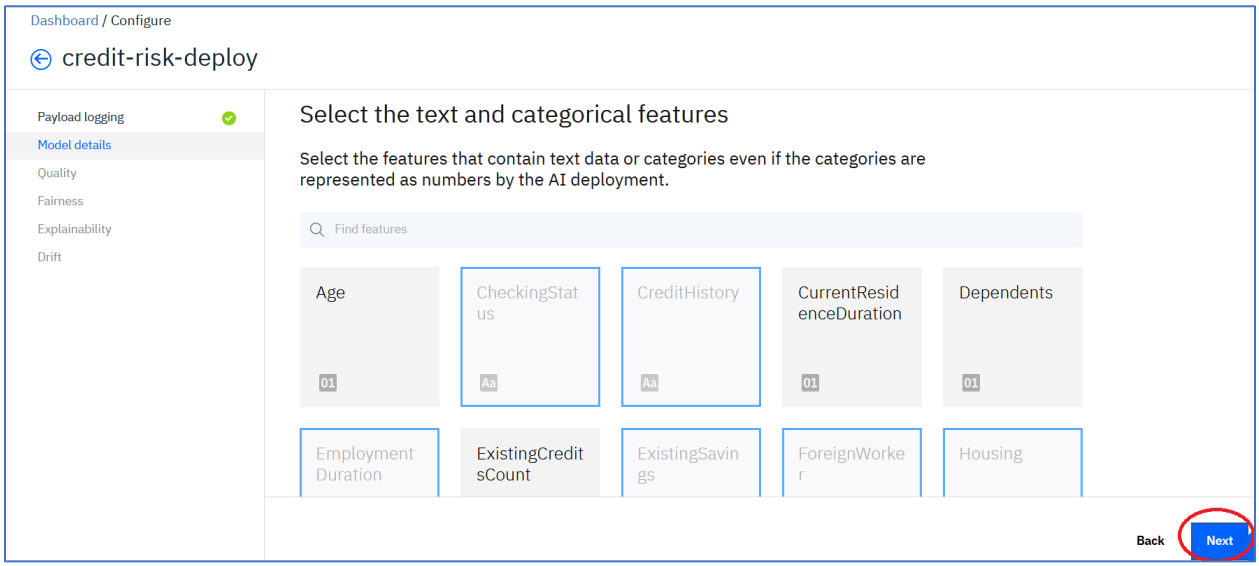
6. Watson OpenScale has determined that **Risk** is the label (target) column. Click **Next**.



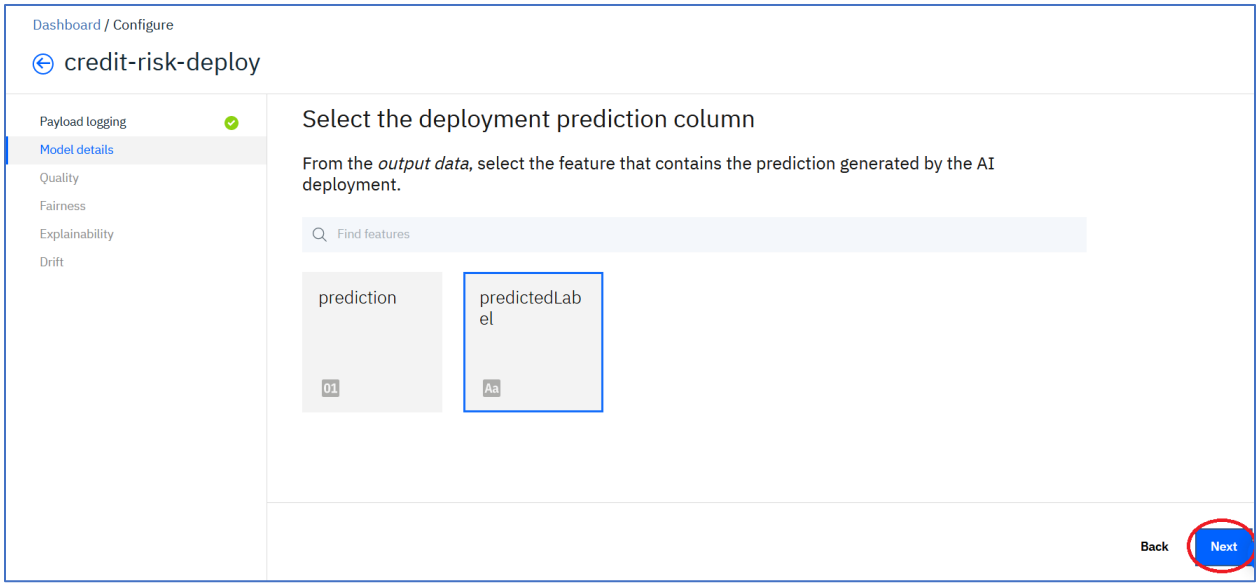
7. All of the features were used to train the model. Click **Next**.



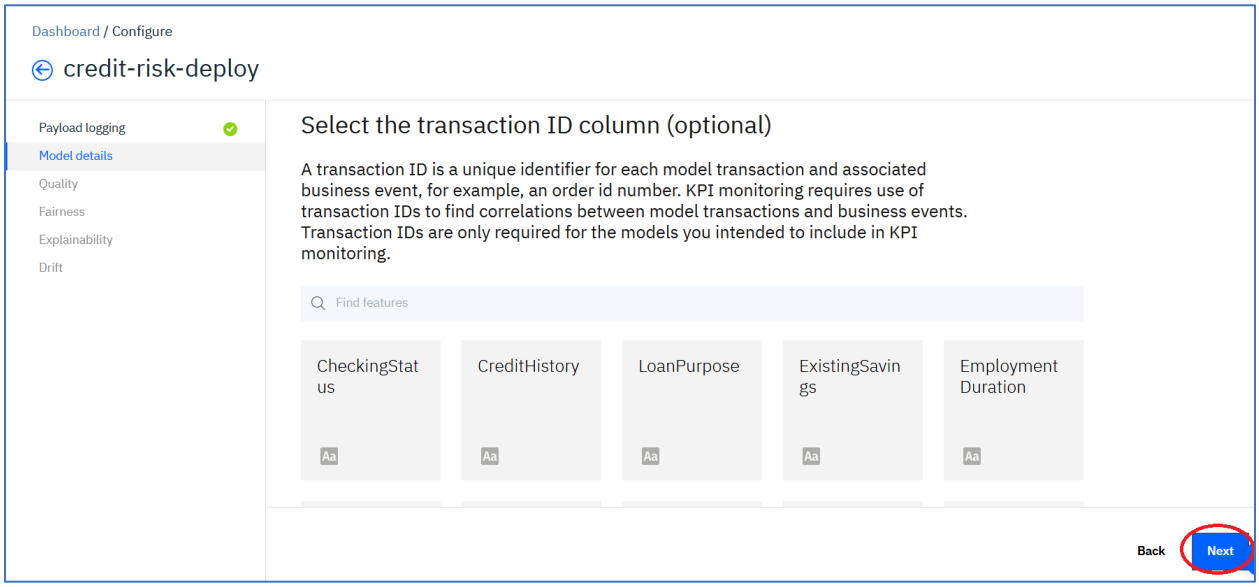
8. Watson OpenScale has determined the text and categorical features. Click **Next**.



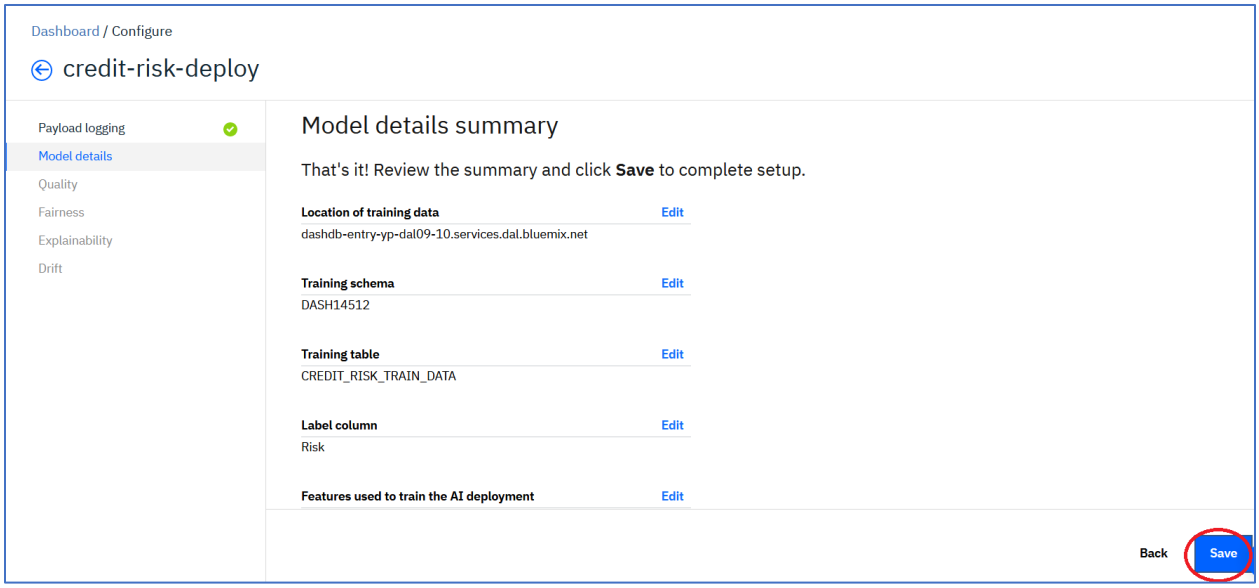
9. Watson OpenScale has determined the feature that contains the prediction generated by the AI deployment. Click **Next**.



10. Click **Next.**



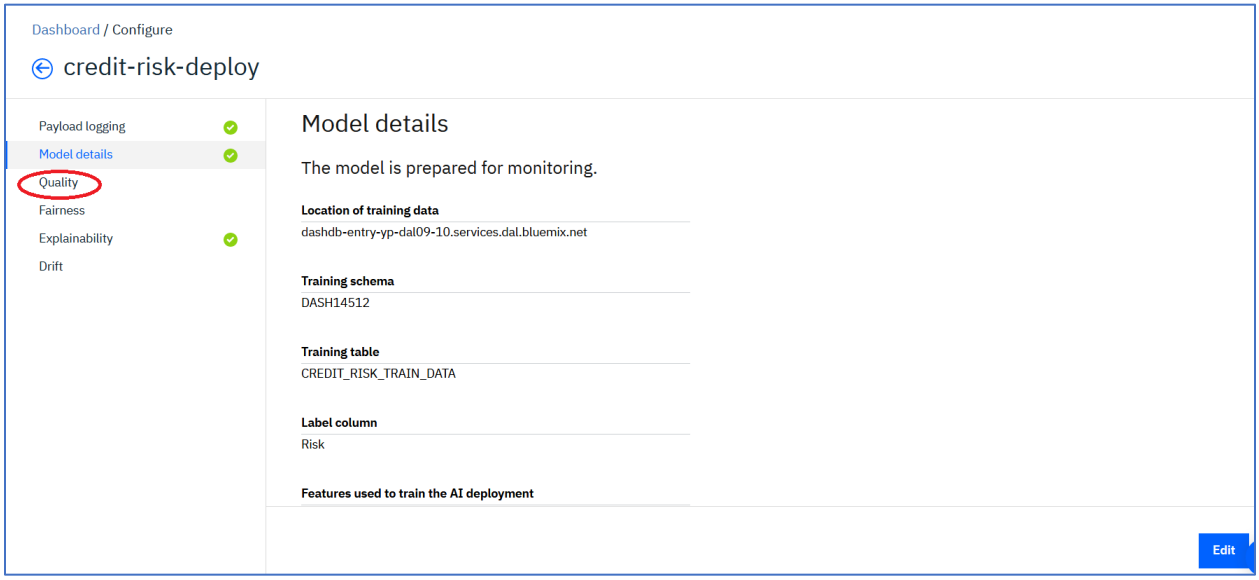
11. The Model details summary is displayed. You have the option to edit the parameters. Click **Save.**



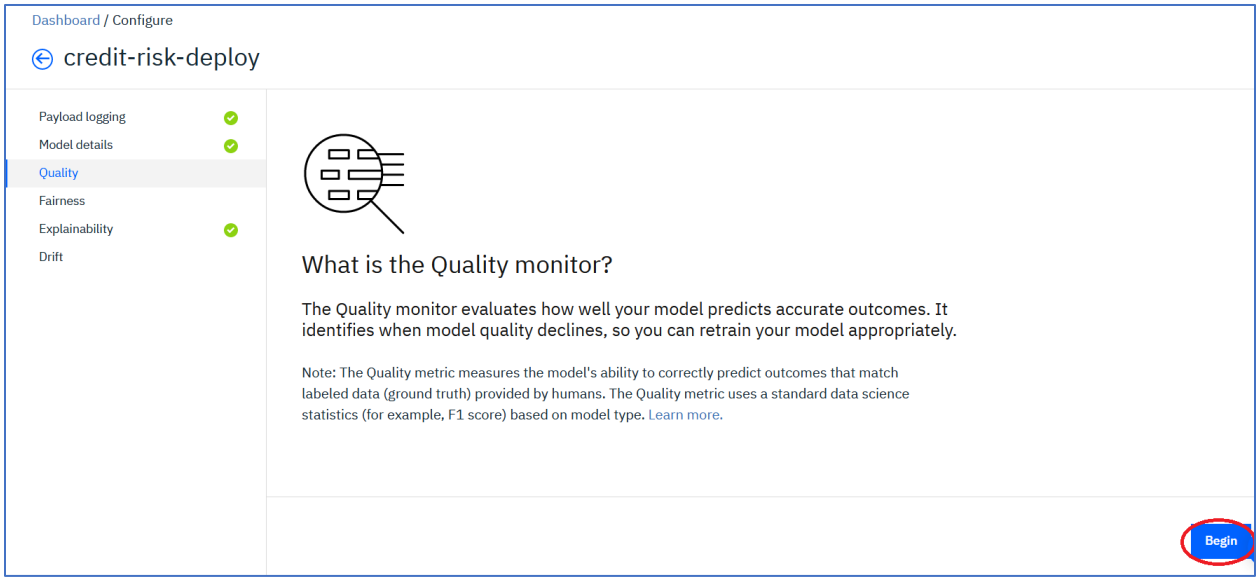
Configure Quality

The Quality Monitor evaluates how well your deployed model predicts accurate outcomes. It identifies when model quality declines so you can retrain appropriately.

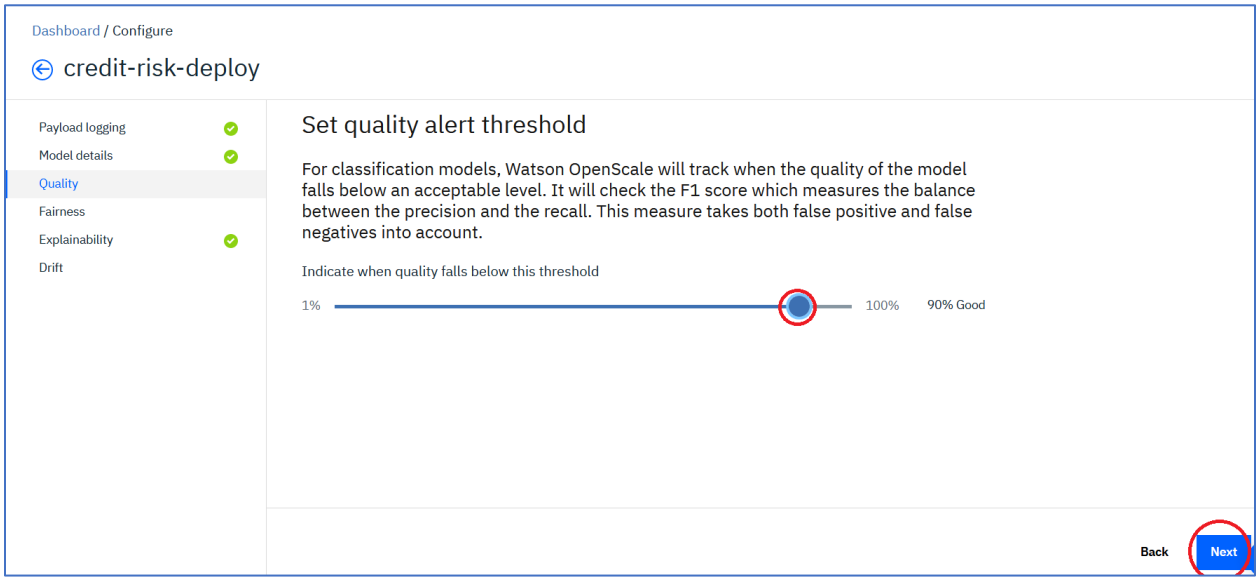
1. Click on **Quality** to configure the Quality monitor.



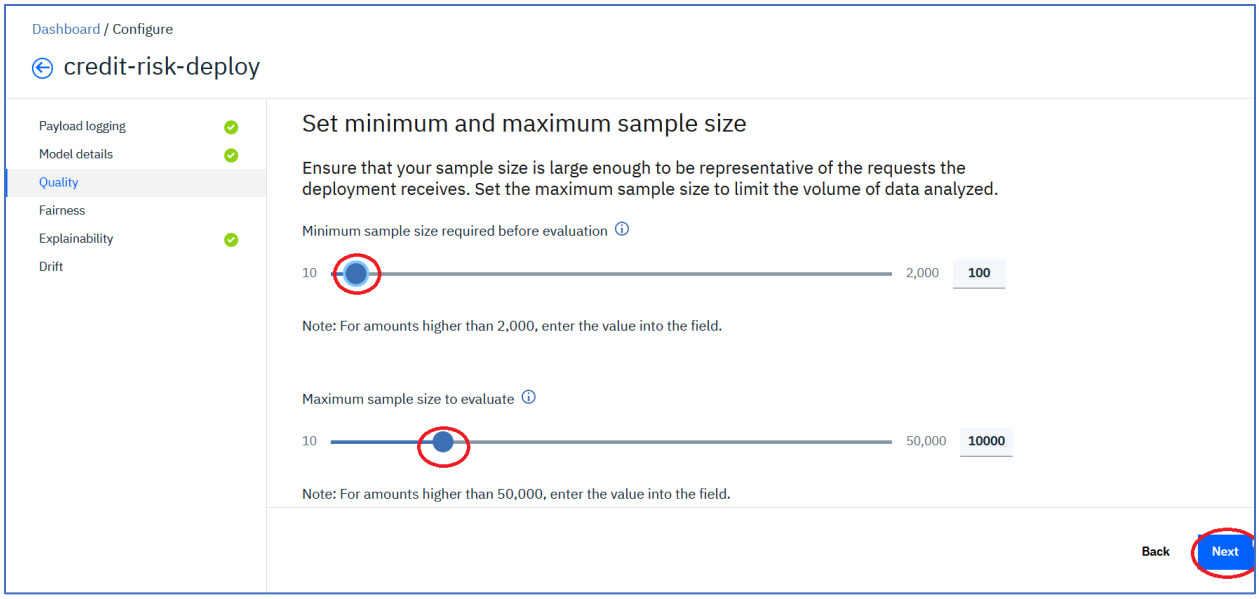
2. Click on **Begin**.



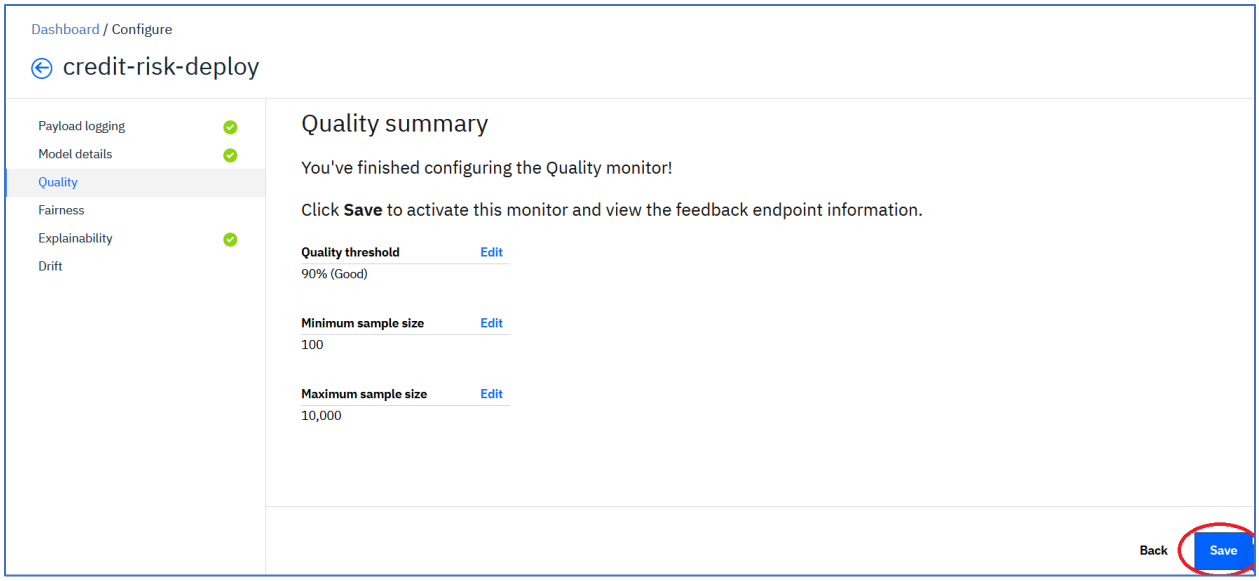
3. Set the quality alert threshold. 90% is chosen below. Click **Next**.



4. Set minimum and maximum values for the sample size to be analyzed for quality. 100 is chosen for the minimum sample size, and 10000 is chosen for the maximum. Click **Next.**



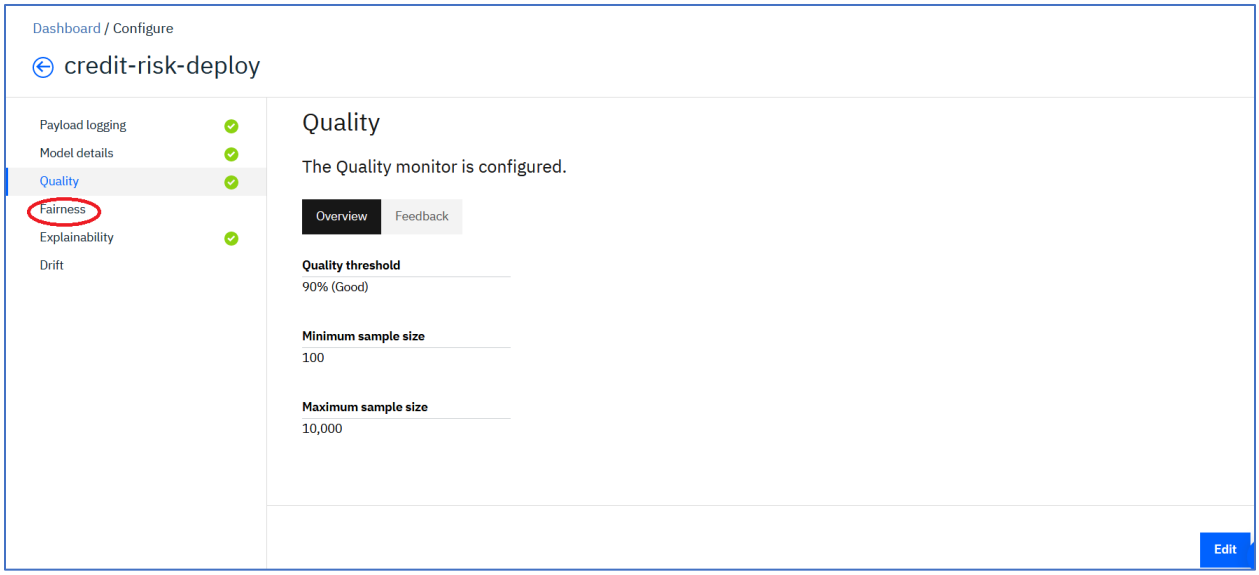
5. The Quality summary is displayed. You have the option of editing the parameters. Click **Save**.



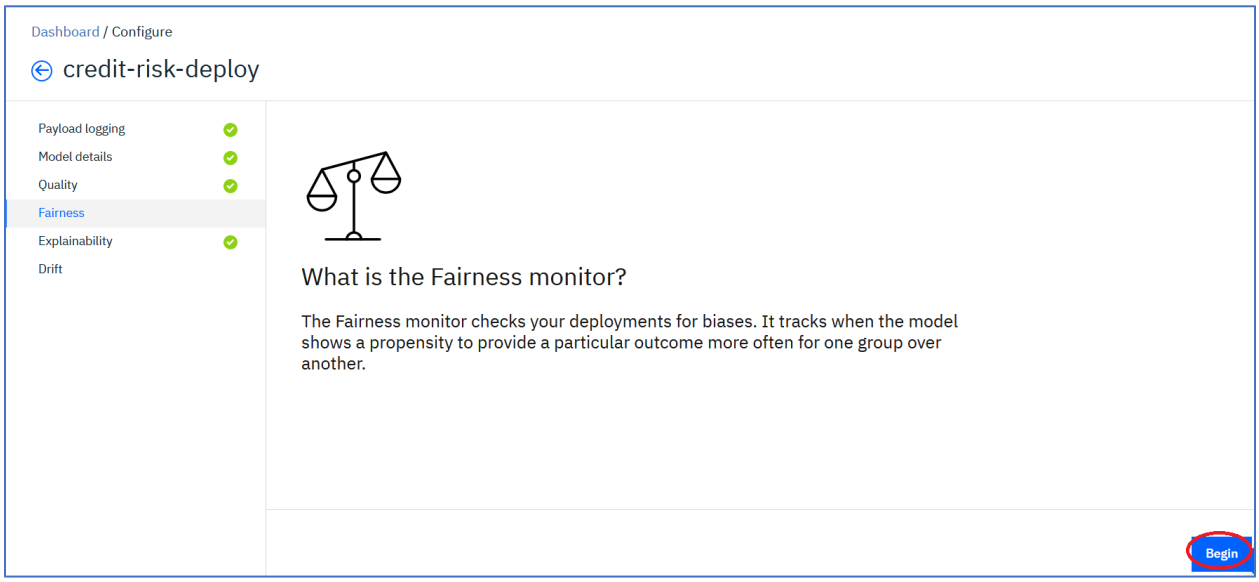
Configure Fairness

The Fairness monitor checks your deployment for biases. It tracks when the model shows a propensity to provide a particular outcome more often for one group over another.

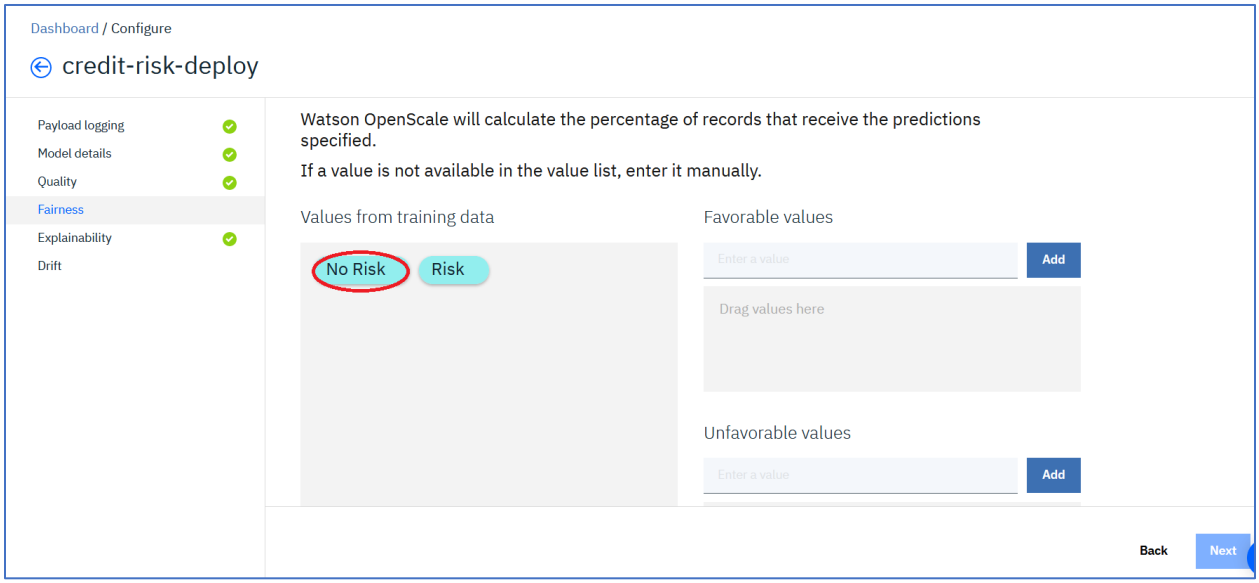
1. Click on **Fairness** to configure the Fairness monitor.



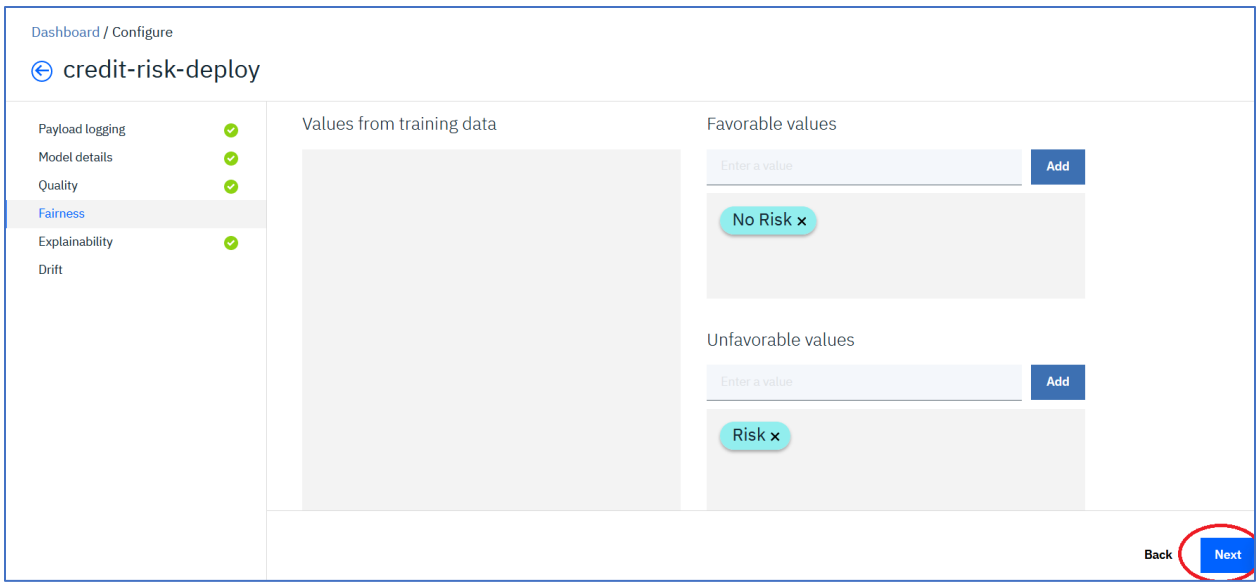
2. Click **Begin**.



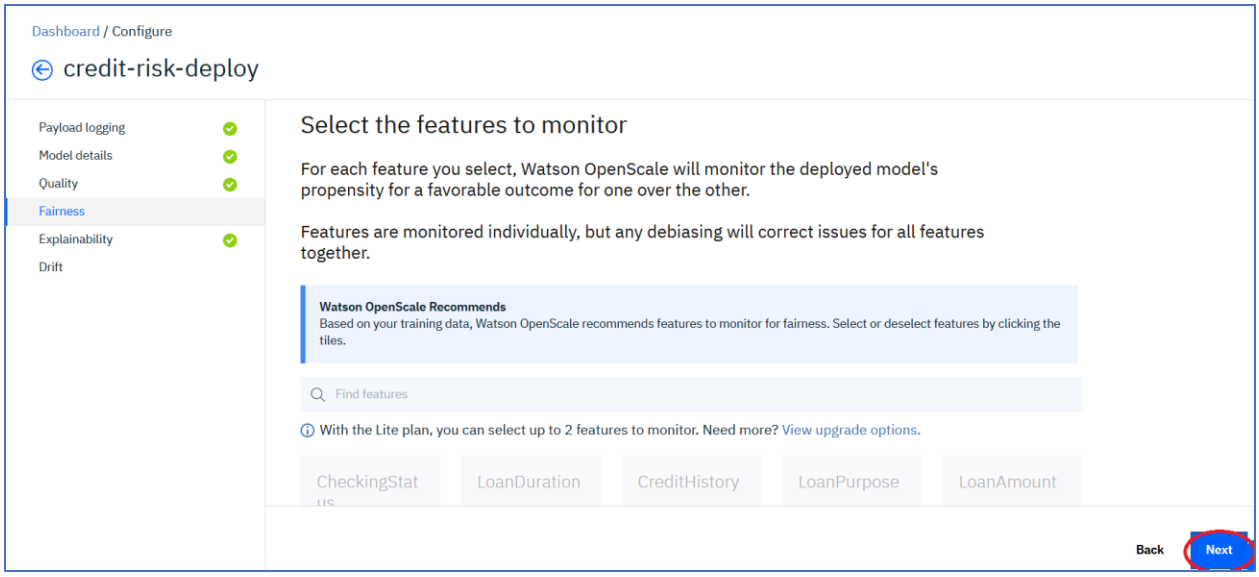
3. Click on **No Risk** and drag to the **Favorable values** and drop where it says **Drag values here**.



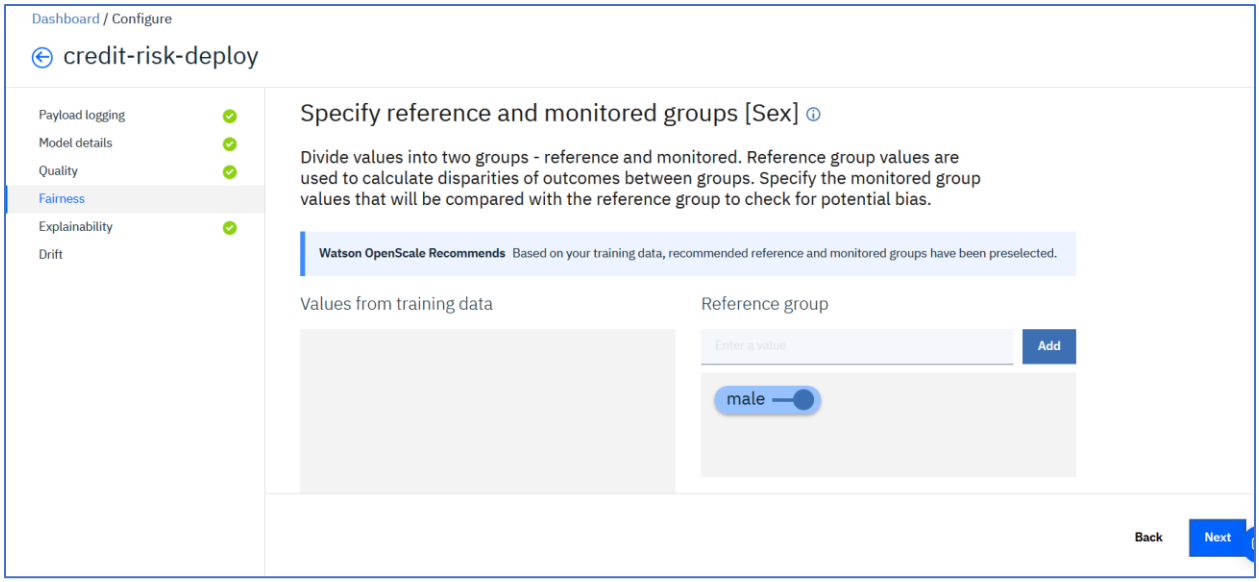
4. Similarly click on **Risk** and drag to the **Unfavorable values** and drop where it says **Drag values here**. Click **Next**.



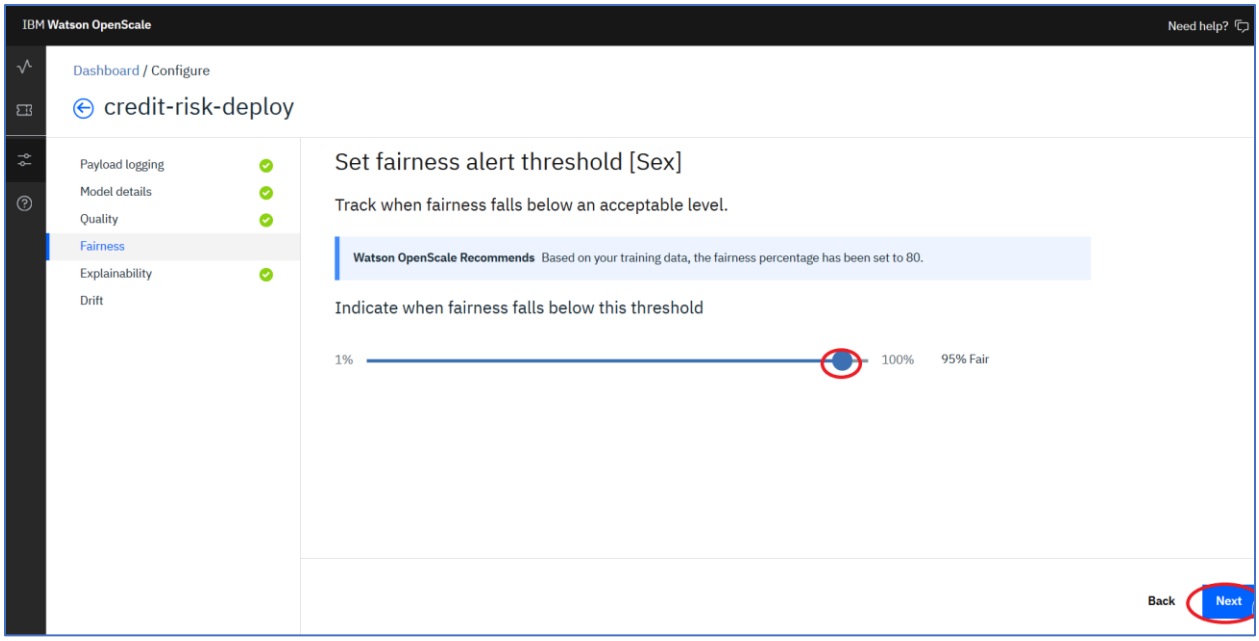
5. Select the features to monitor. Watson OpenScale has automatically selected **Sex** and **Age**. Click **Next**.



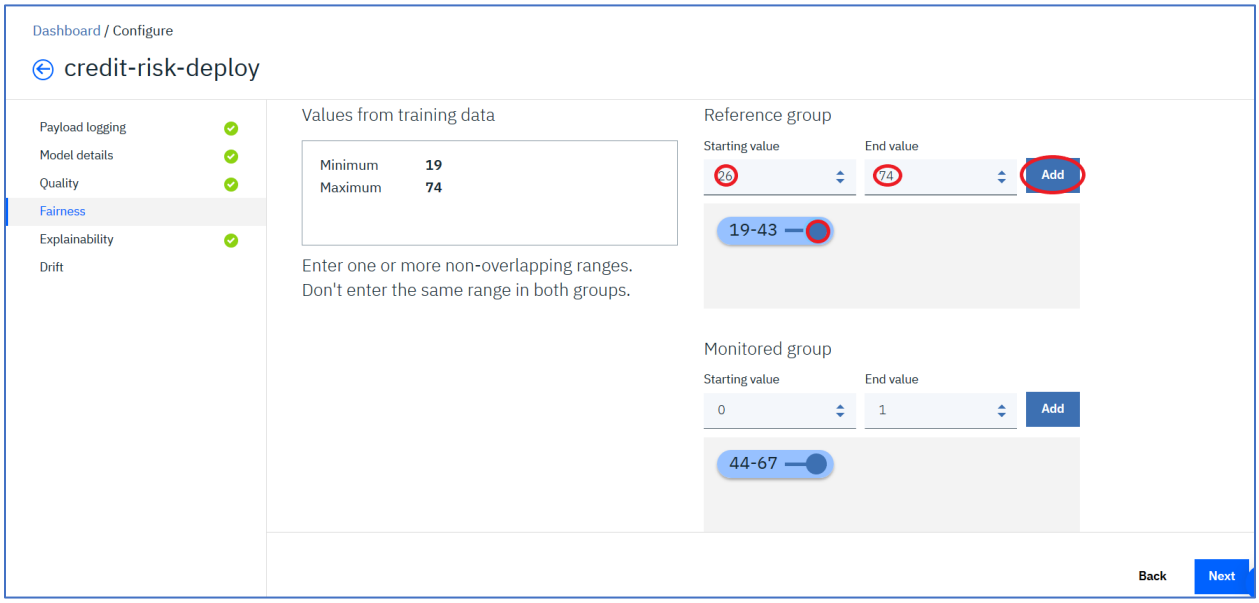
6. Set the values for Sex that represent the Reference group versus the Monitored group. Watson OpenScale automatically selected these values. Click on **Next.**



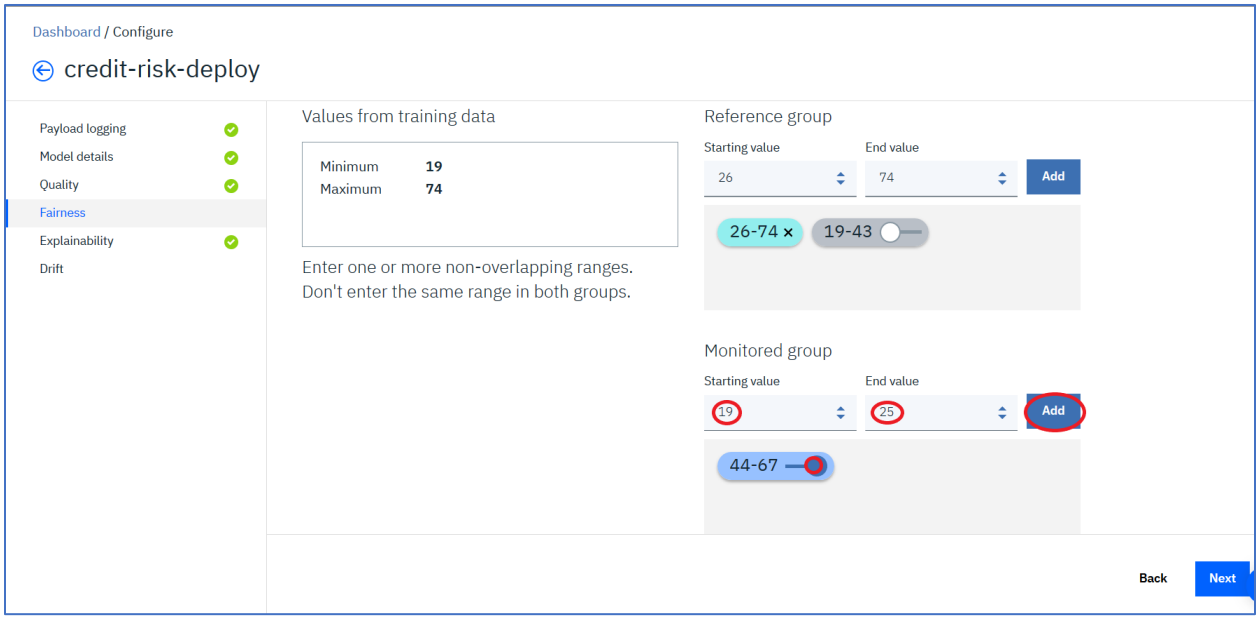
7. Set the fairness alert threshold value for Sex. Use a value of 95%. Click **Next**.



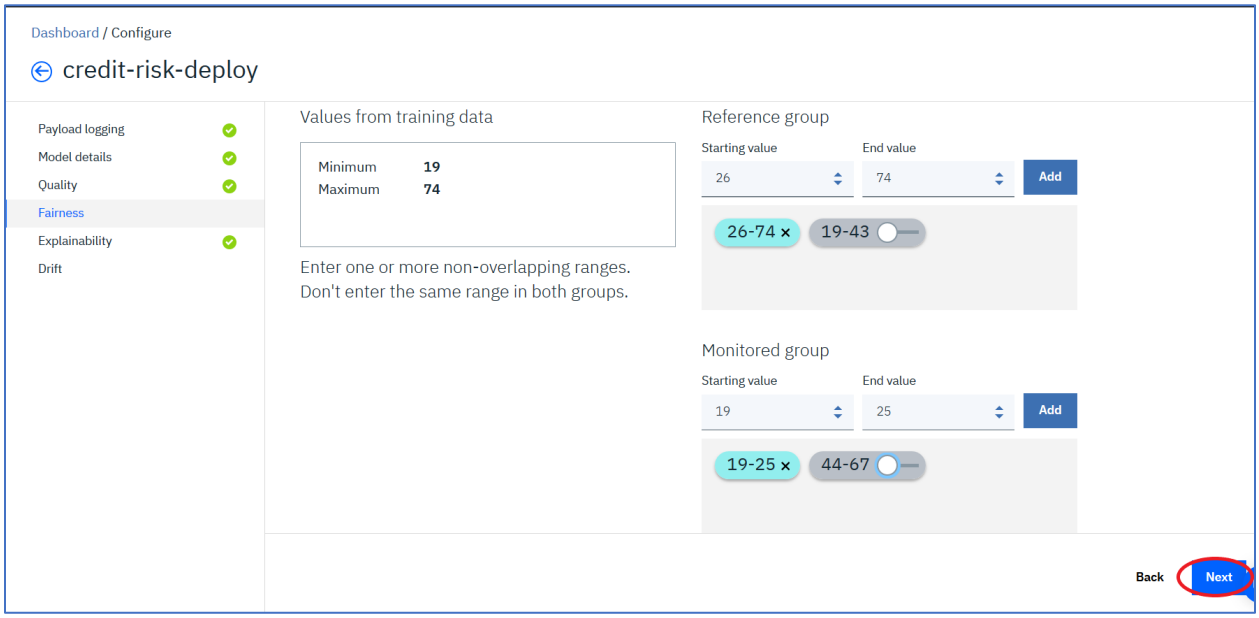
8. Set the values for Age that represent the Reference group versus the Monitored group. Note that Watson OpenScale automatically selects a range of values. We will change the default values. Click on the filled circle in the Reference group, enter **26** as the **Starting value**, enter **74** as the **End** value, and click on **Add**.



9. Click on the filled circle in the **Monitored group**, enter **19** for the **Starting value,** enter **25** for the **End value**, and click on **Add**.

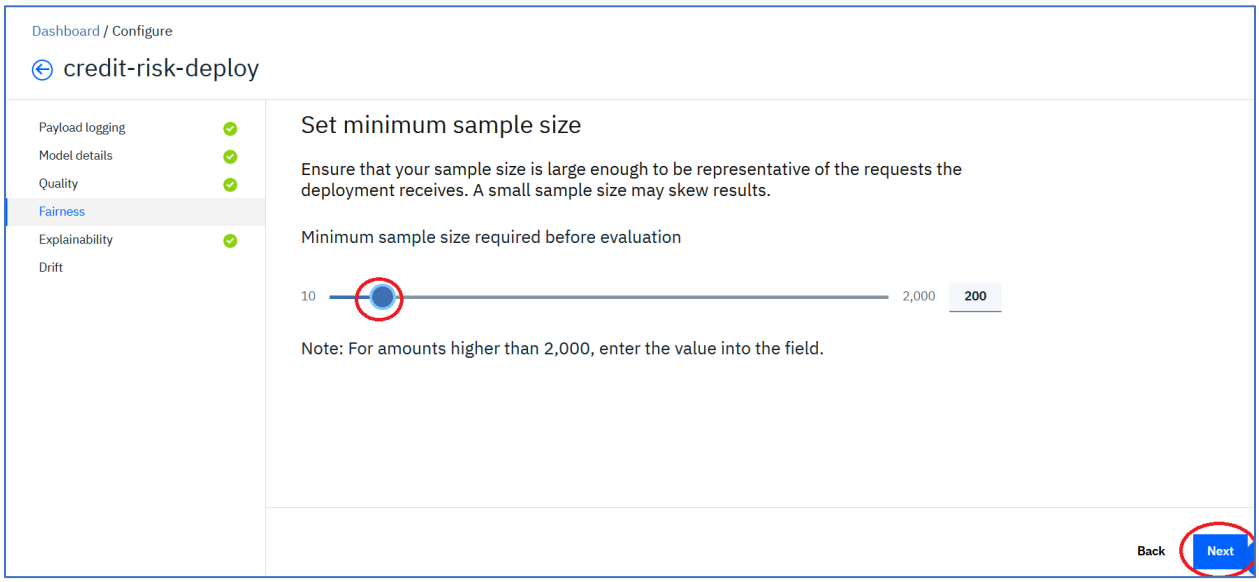


10. Click **Next**.

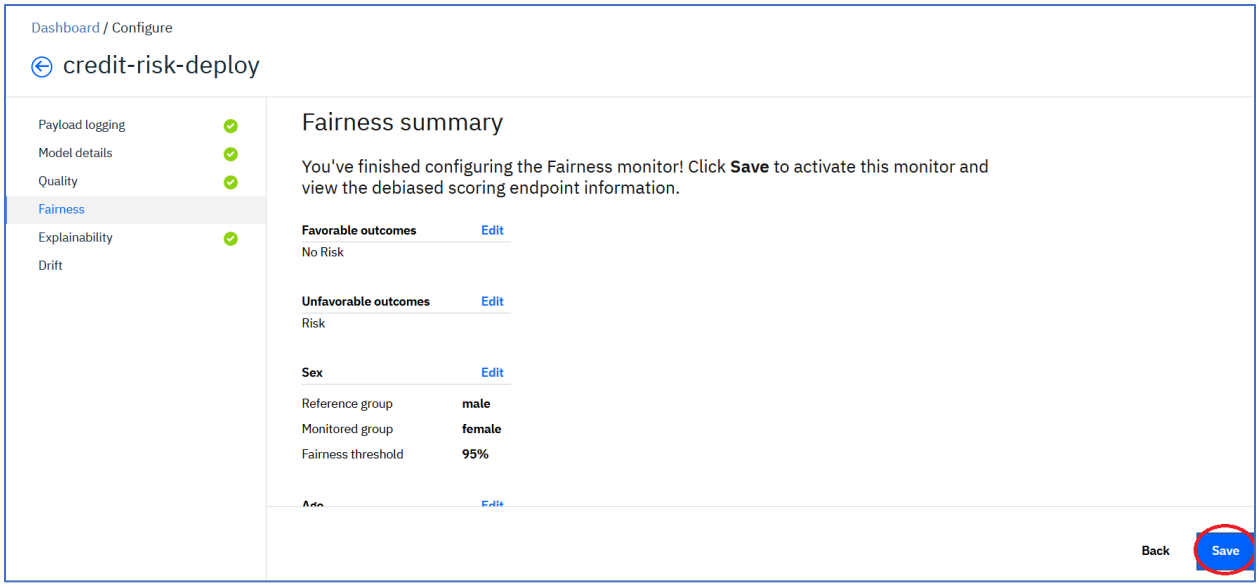


11. Set the fairness alert threshold for Age**.** Select **95%.** Click **Next**.

12. Set the minimum sample size to compute fairness. Select **200**. Click **Next**.



13. The Fairness Monitor summary is displayed. You have the option to Edit the parameters. Click **Save**.



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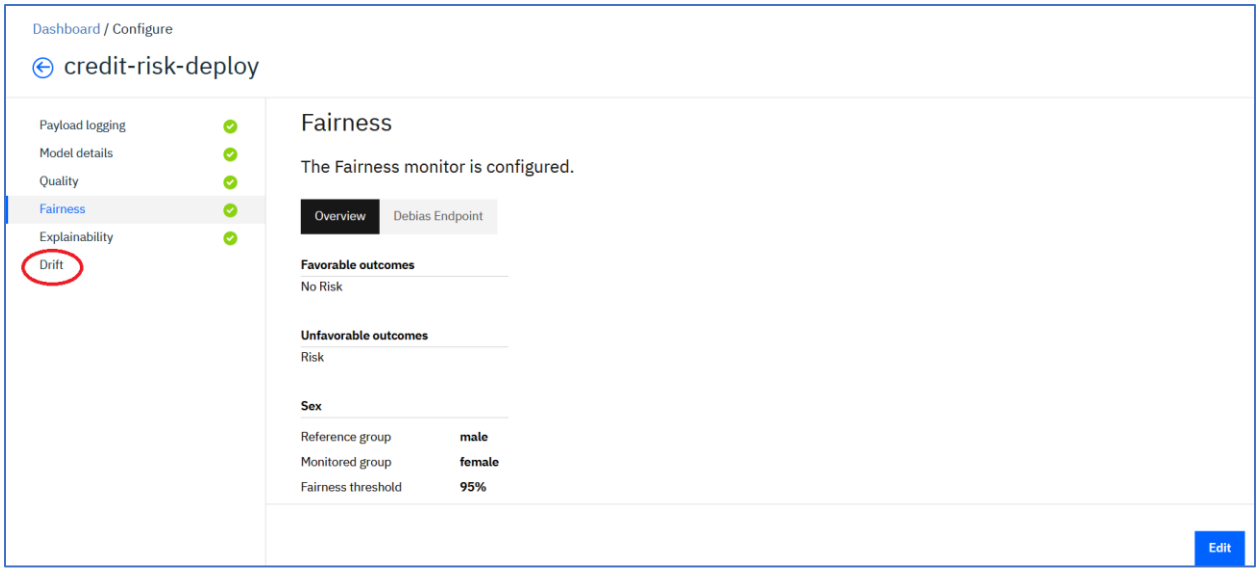
Configure Drift

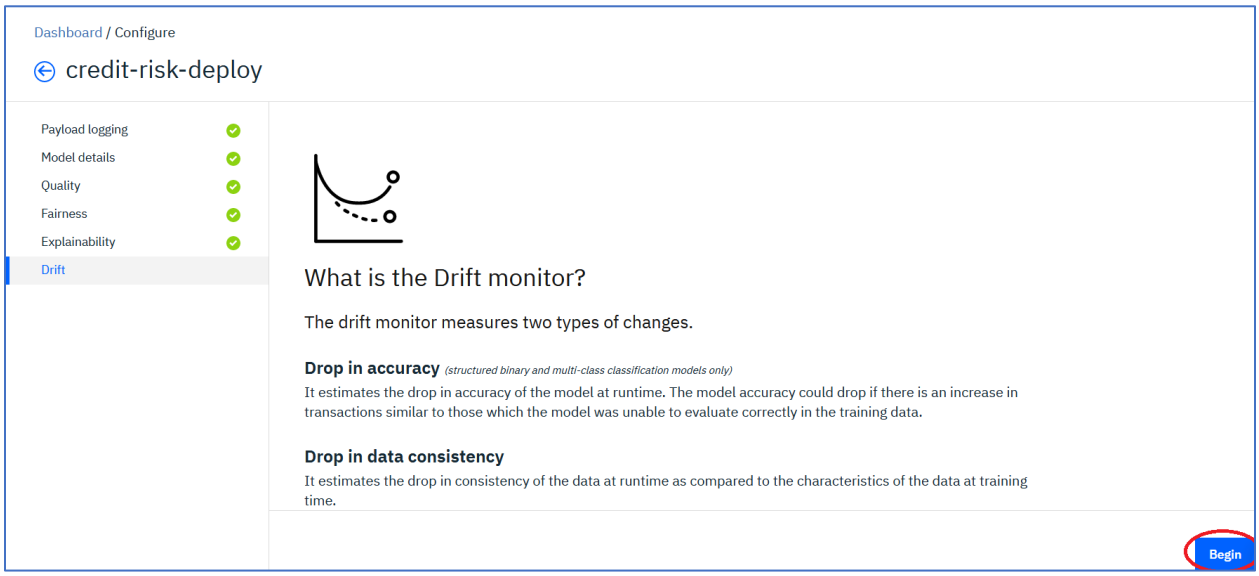
The Drift monitor measures two types of changes. It measures the drop in accuracy of the deployed model during runtime. The model accuracy could drop if there is an increase in the number of transactions similar to ones that the model was not able to accurately evaluate in the training data.

It measures the drop in consistency of the data in runtime as compared to the characteristics of the data at training.

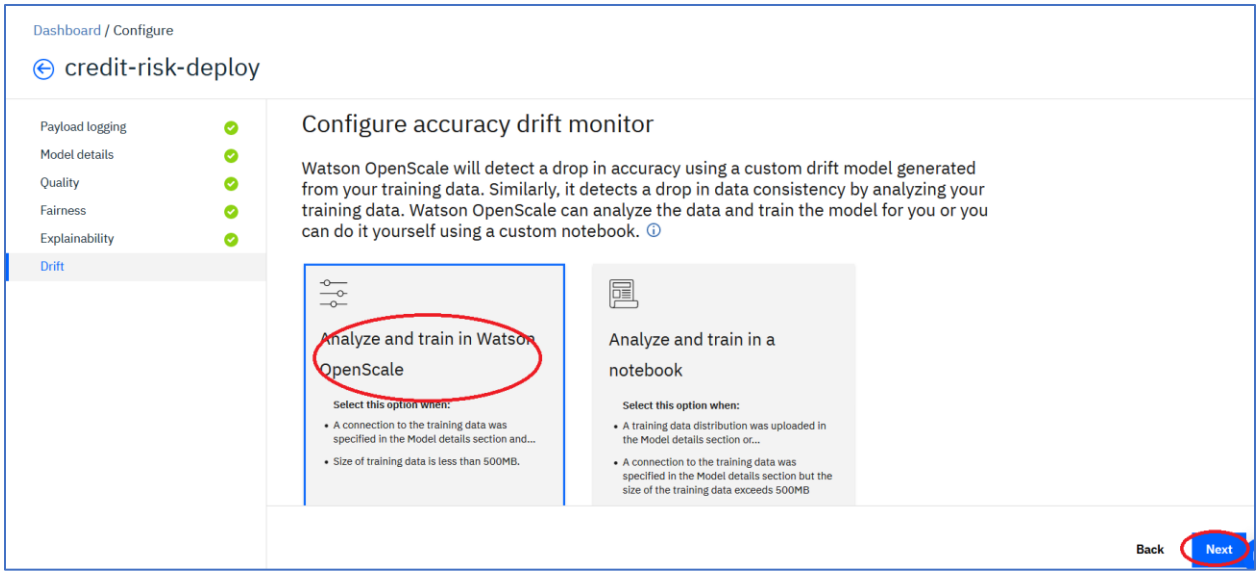
1. Click on **Drift** to configure the Drift monitor.



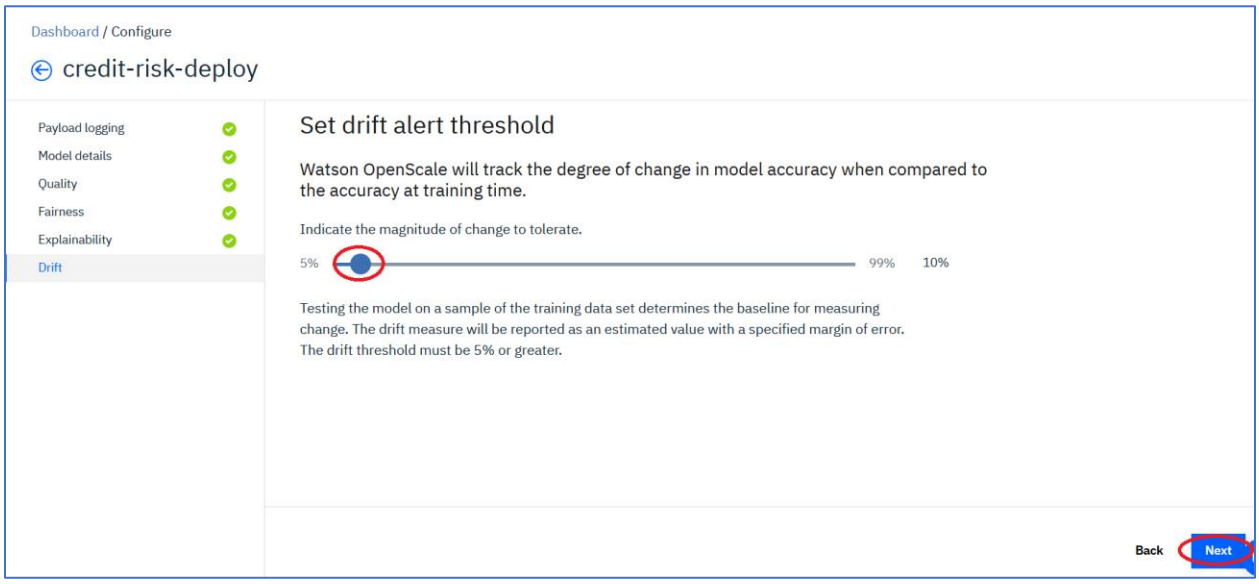
2. Click **Begin**.



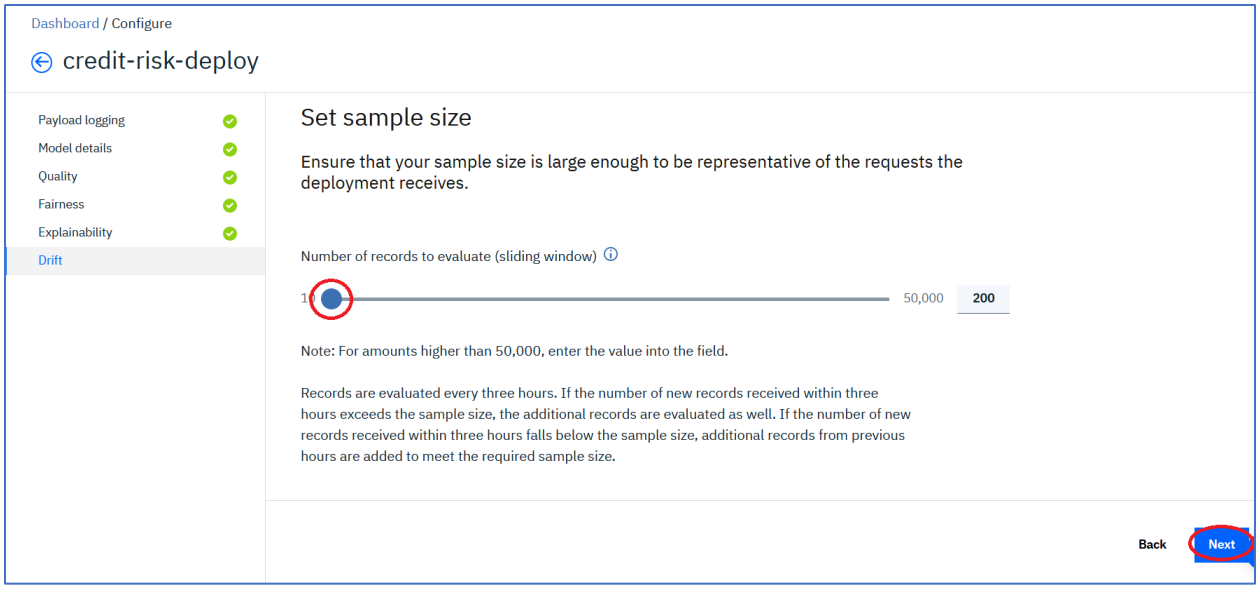
3. Watson OpenScale will detect a drop in accuracy using a custom drift model generated from the training data. Similarly, it detects a drop in data consistency by analyzing your training data. Click on **Analyze and train in Watson OpenScale**. Click **Next**.



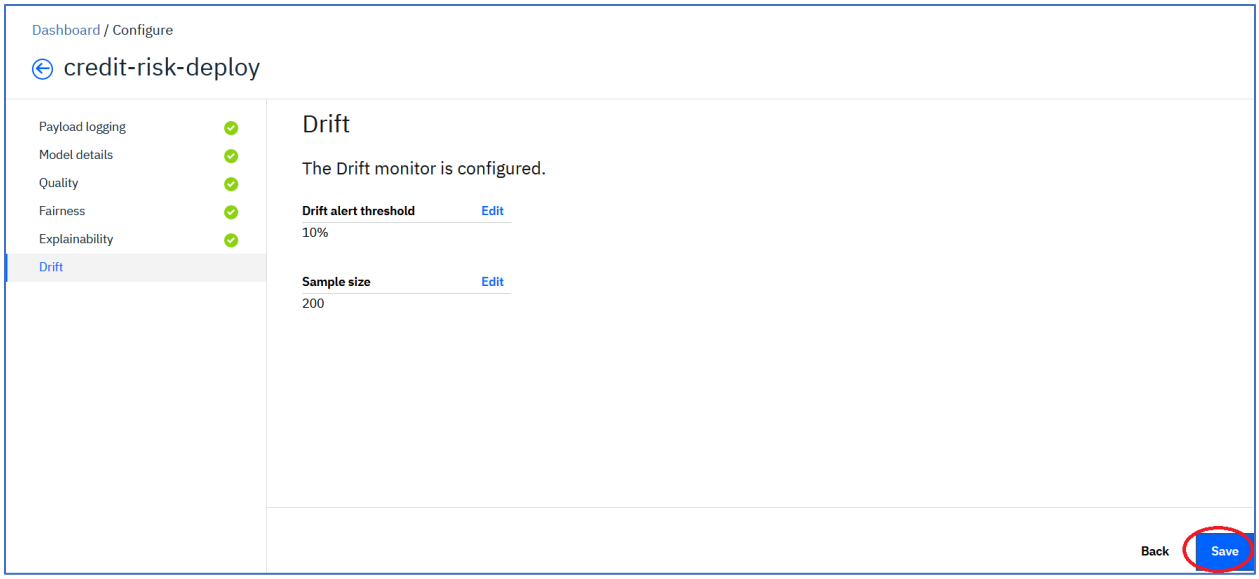
4. Set the drift alert threshold. Select **10%**. Click **Next**.



5. Set the sample size to compute Drift. Select **200**. Click **Next**.



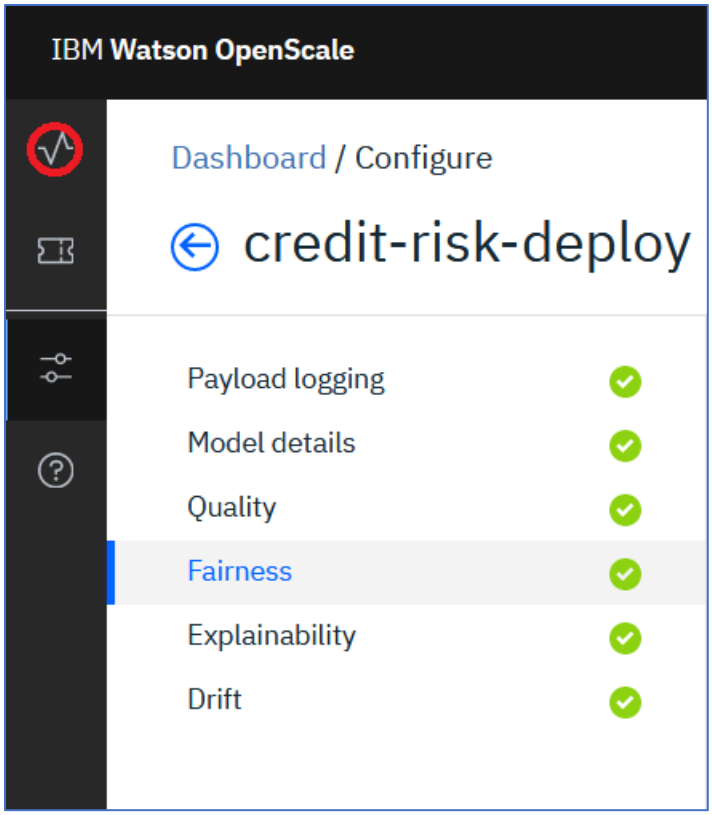
6. The Drift monitor summary is displayed. You have the option of editing the parameters. Click **Save**.



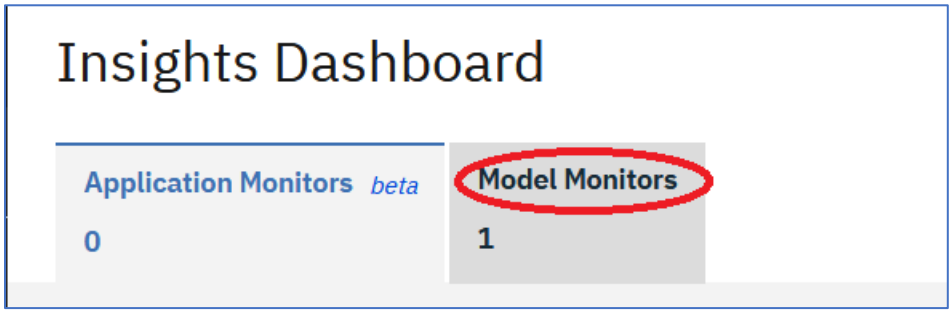
Submit Feedback and View Quality Metrics

In order to measure quality, scored transactions including human labeled feedback must be provided.

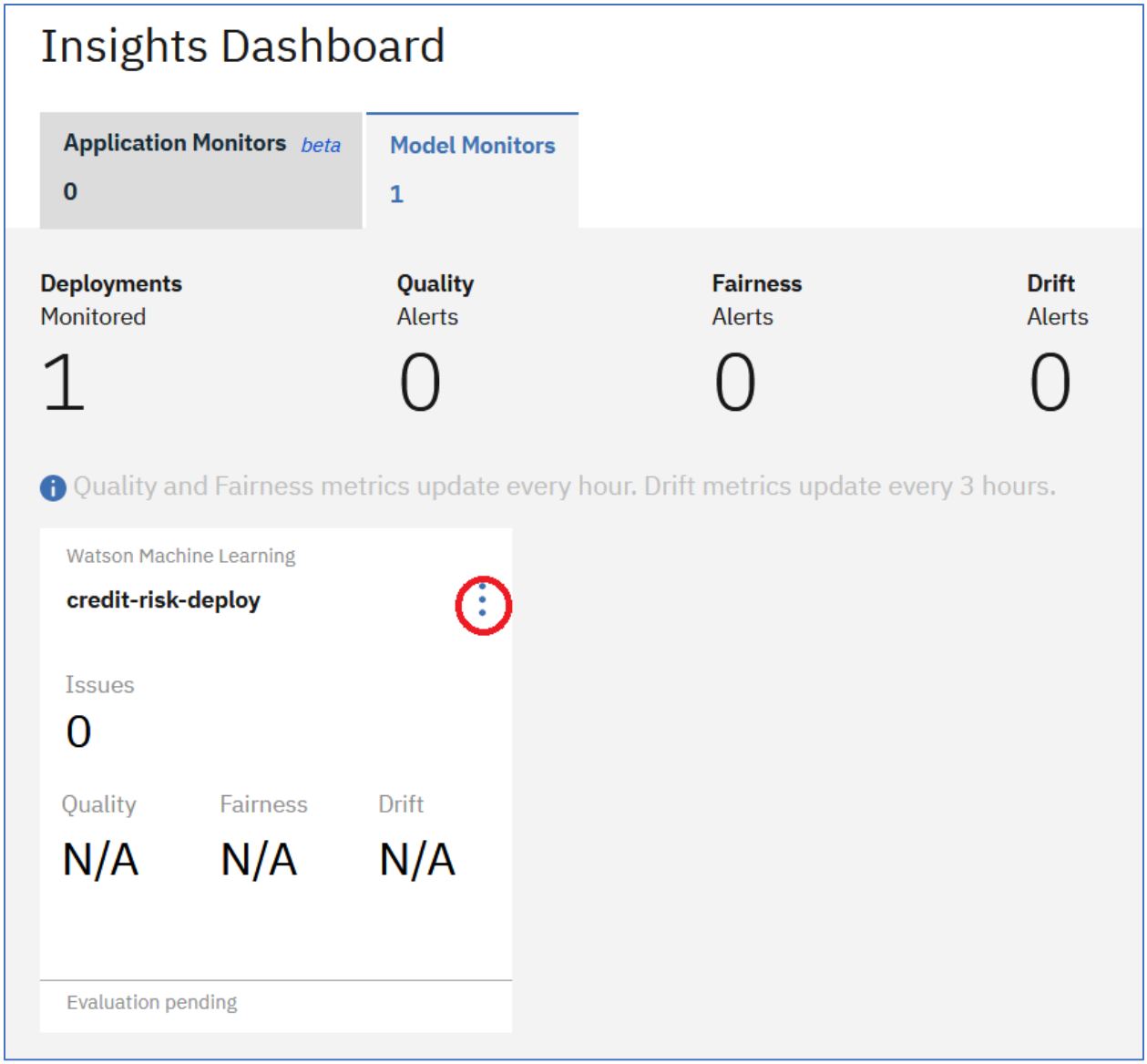
1. Click on the  to display the **Insights Dashboard**.



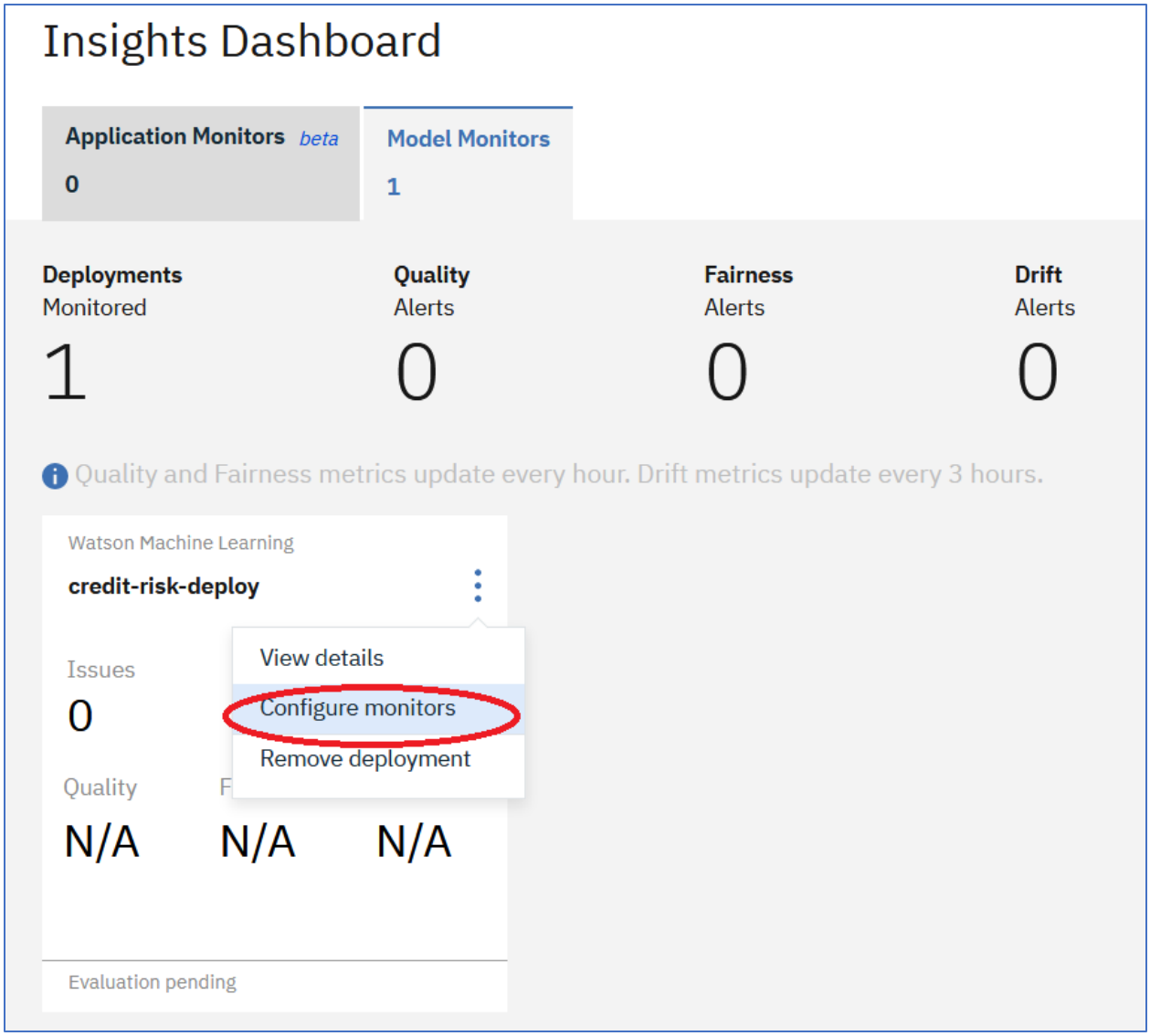
2. Click on **Model Monitors**.



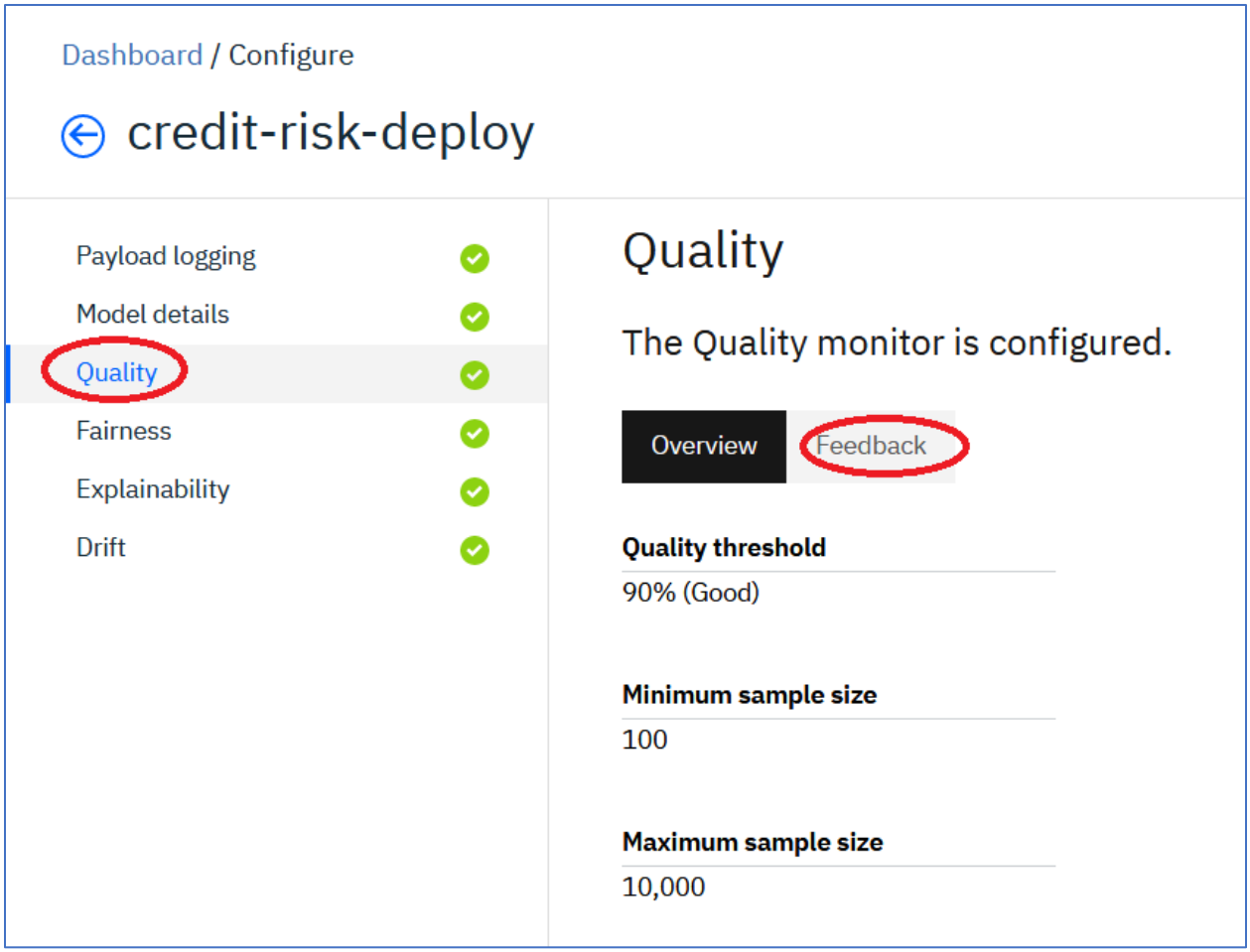
3. Click on vertical ellipse .



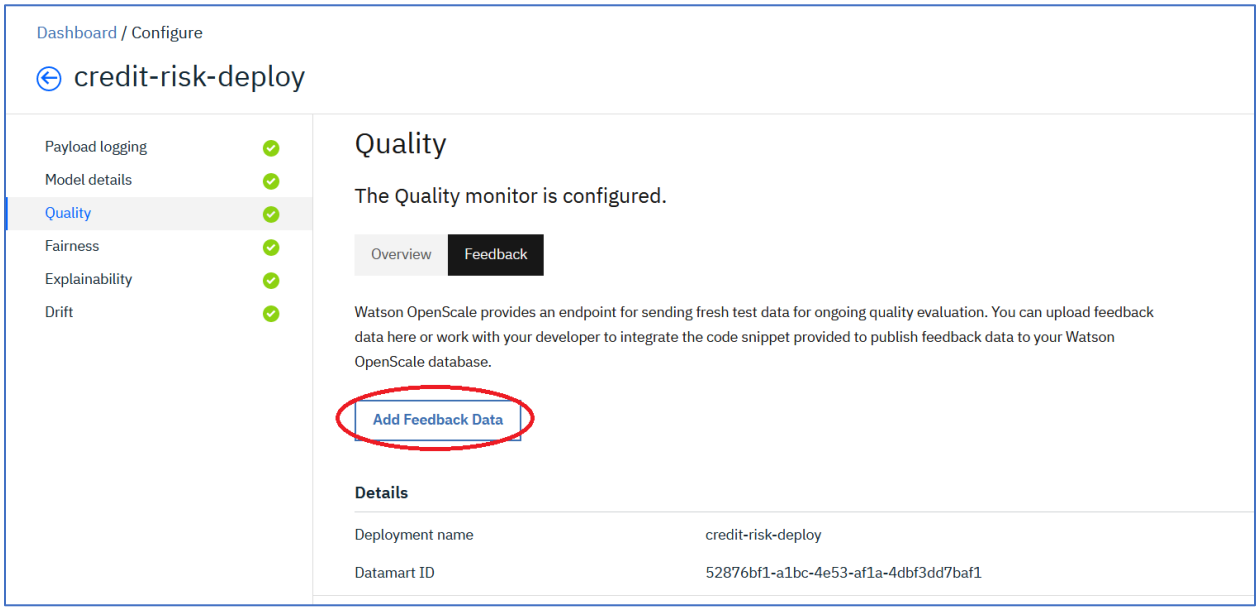
4. Click on **Configure Monitors**.



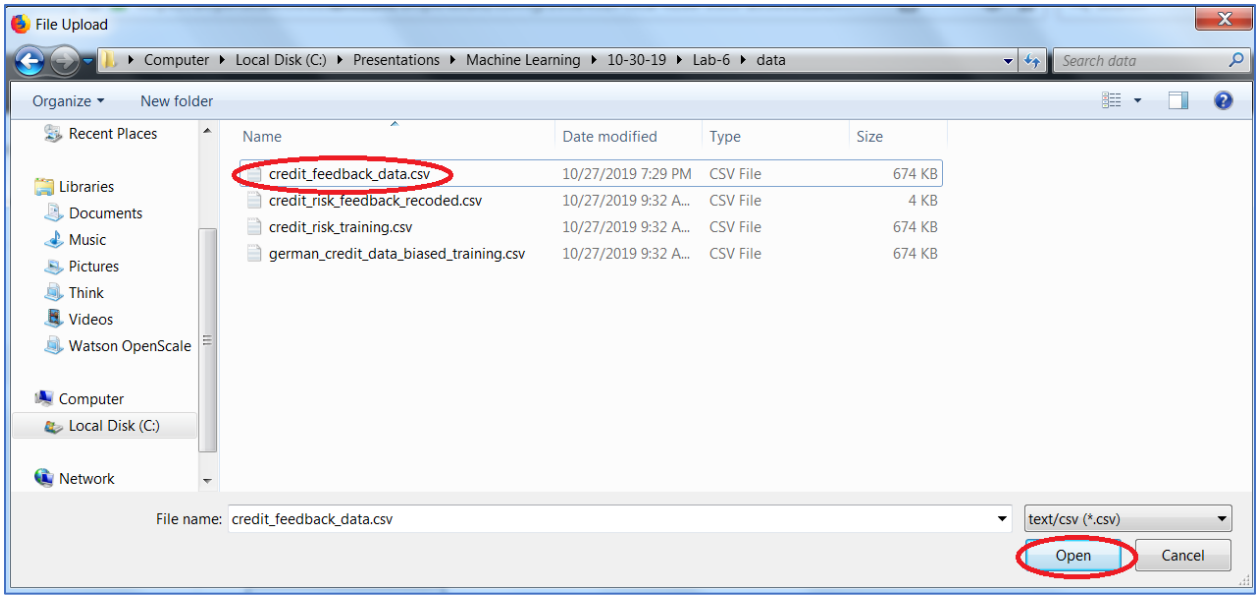
5. Click on **Quality** and then click on **Feedback**.



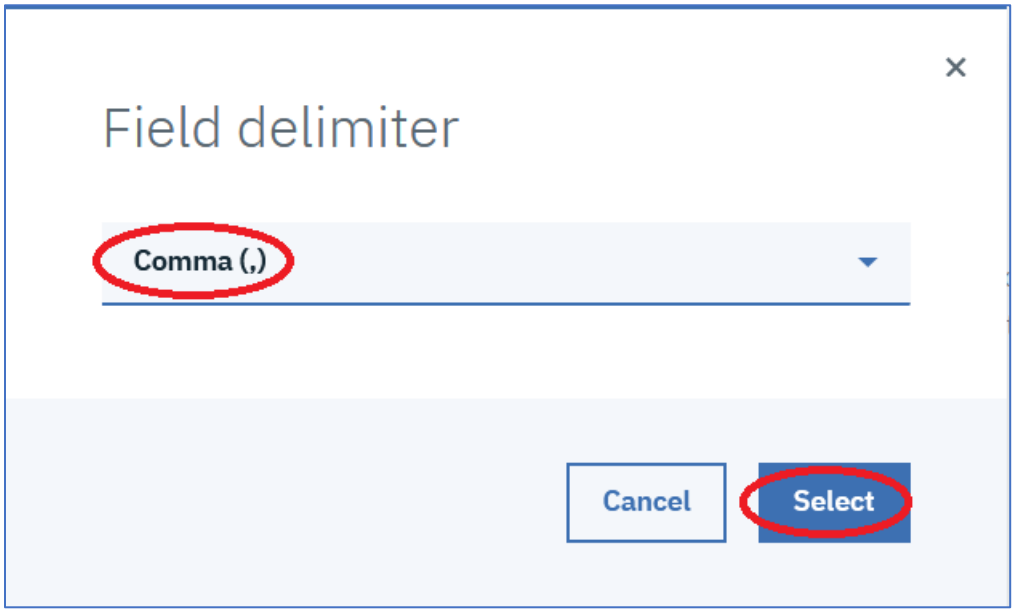
6. Click on **Add Feedback**.



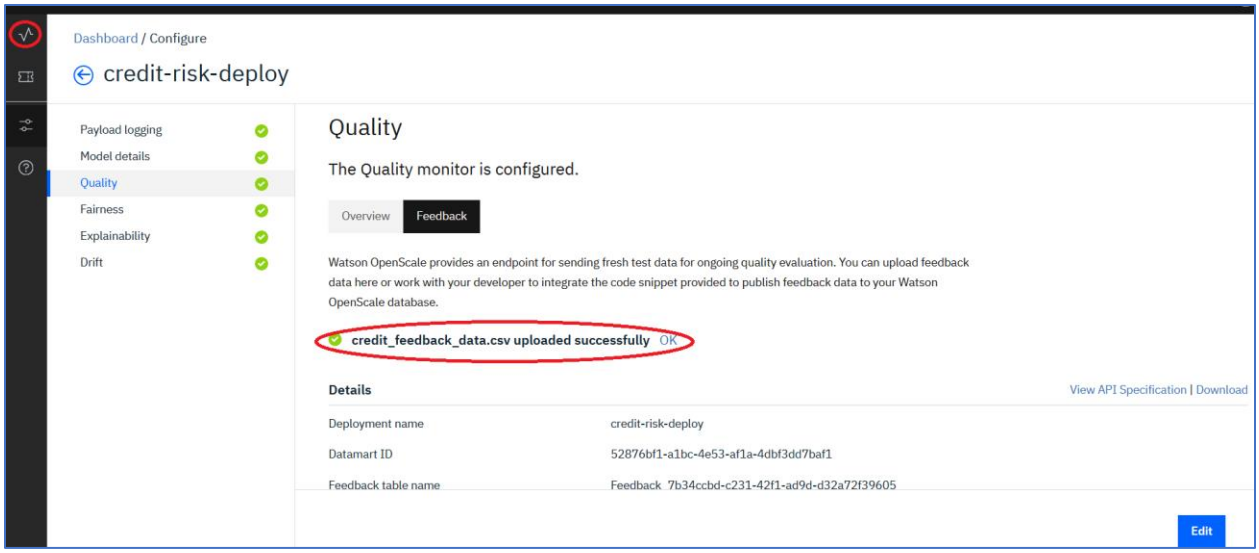
7. Navigate to the feedback file **credit_feedback_data.csv**. Click on **Open**.



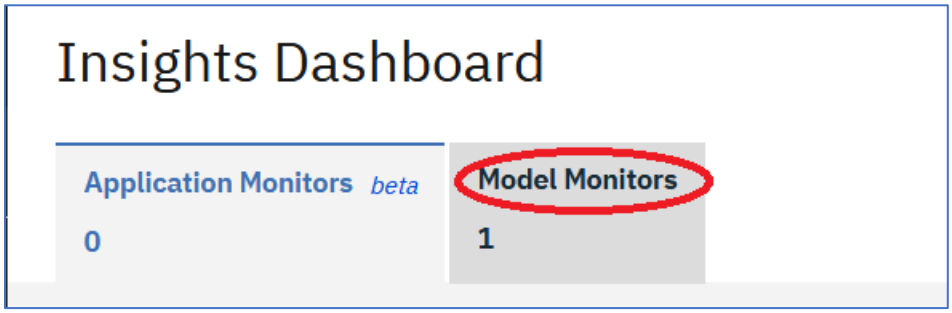
8. Select **Comma** as the **Delimiter**. Click **Select**.



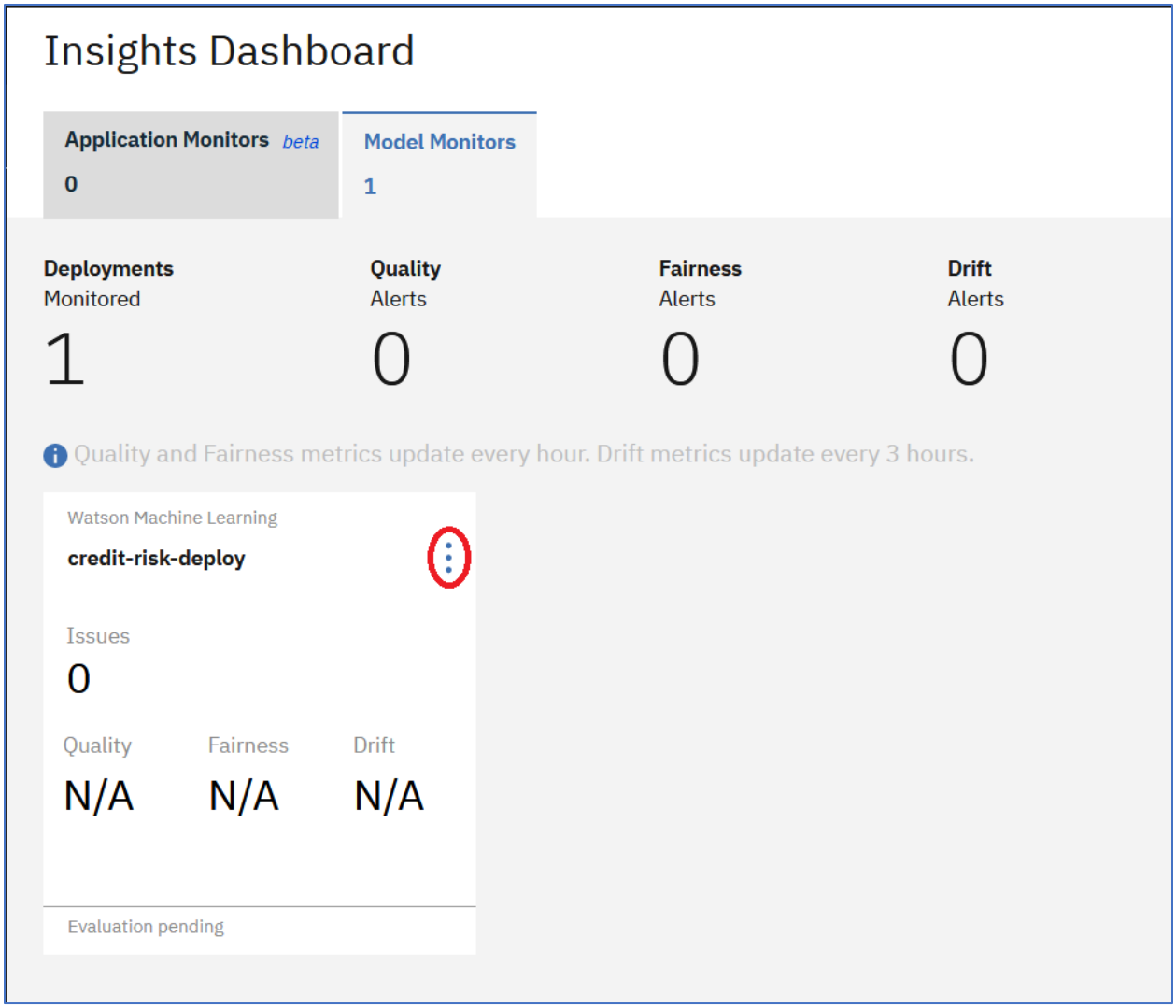
9. After the file is successfully uploaded, click on the  icon.



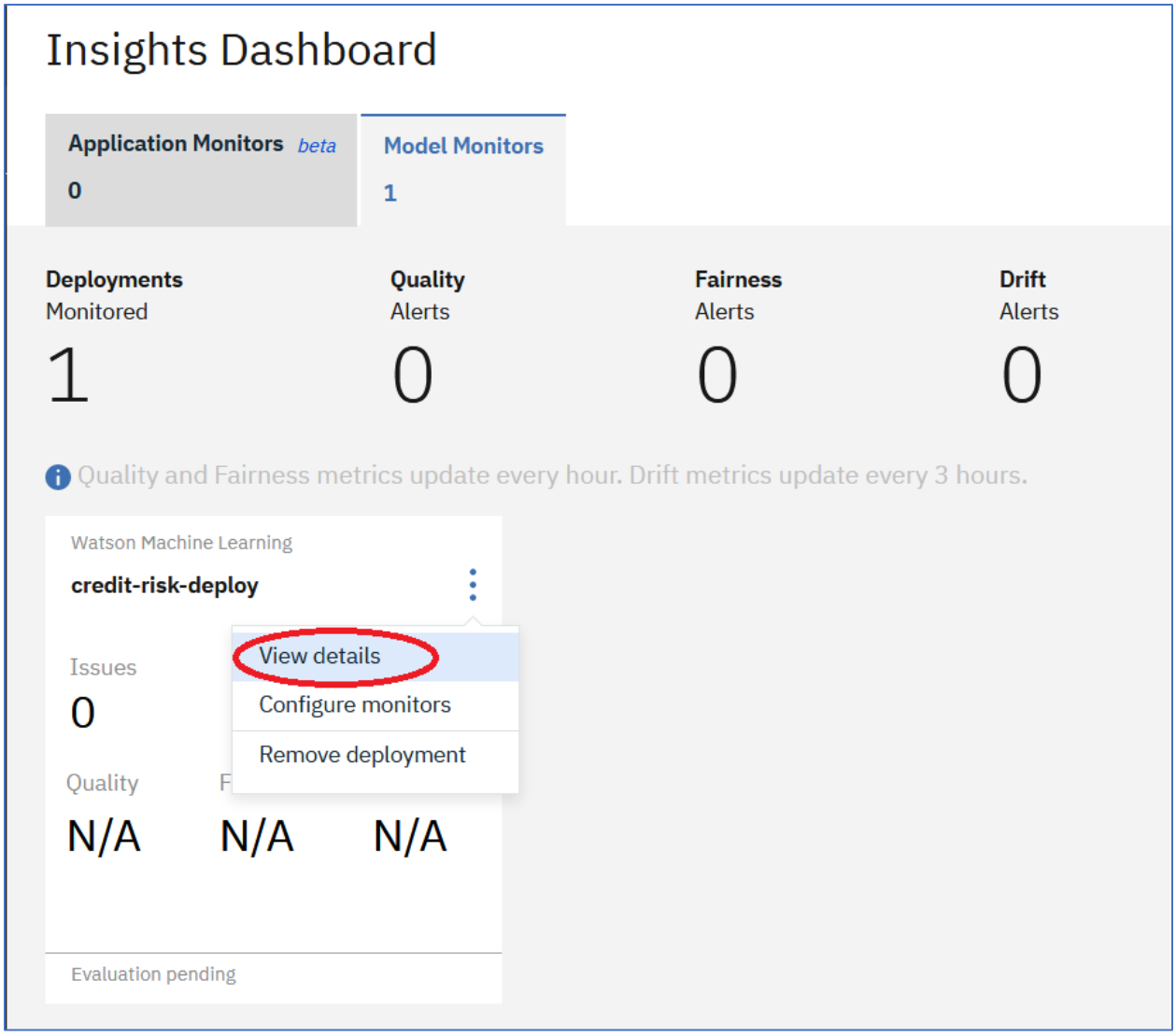
10. Click on **Monitor Models**.



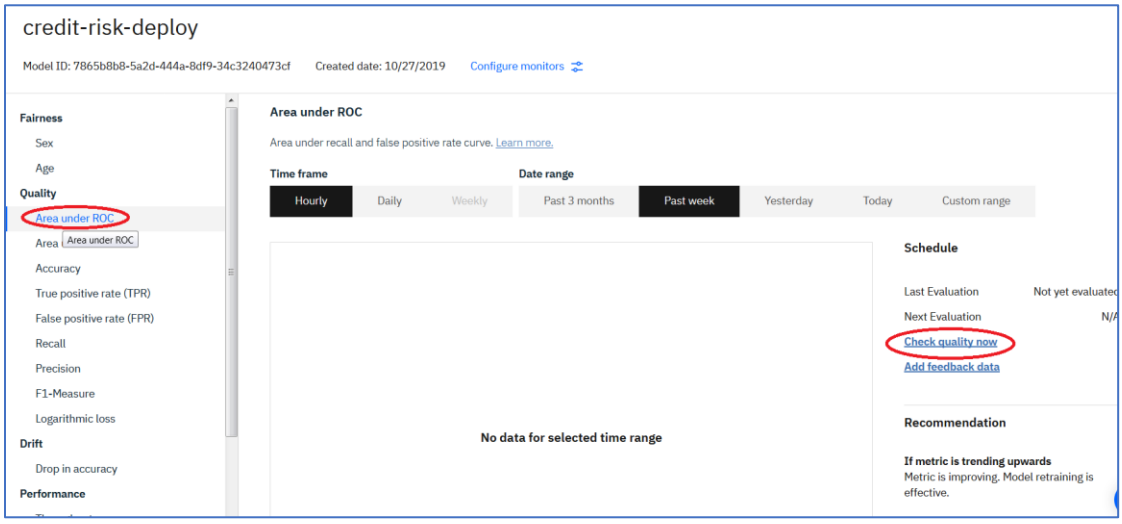
11. Click on the ⋮ icon to evaluate the quality.



12. Click on **View details**.

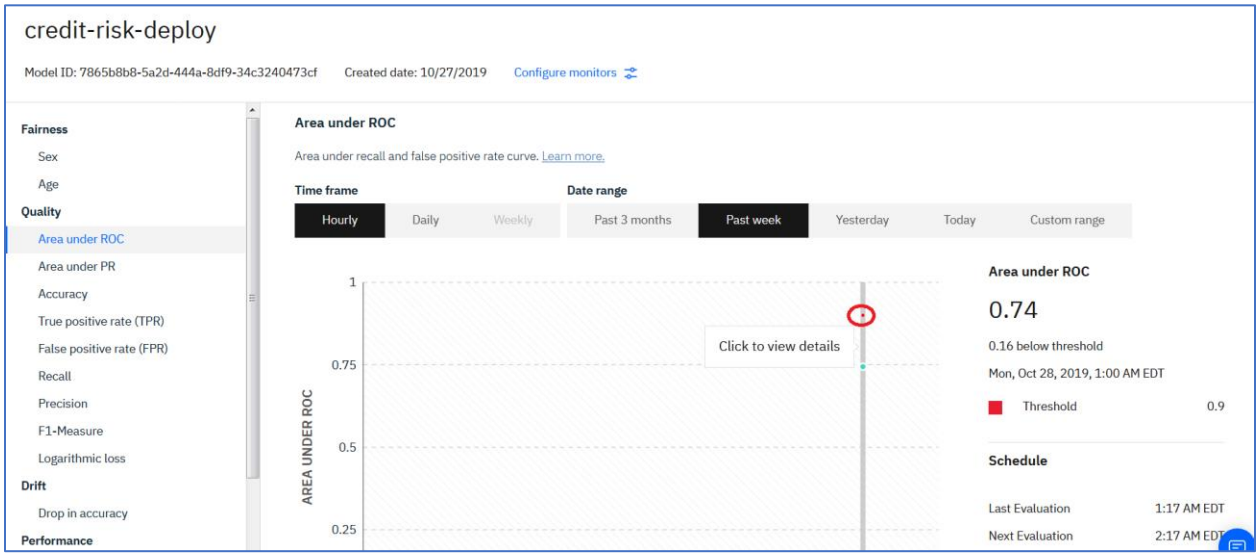


13. Click on **Area under ROC** and click on **Check quality now**.

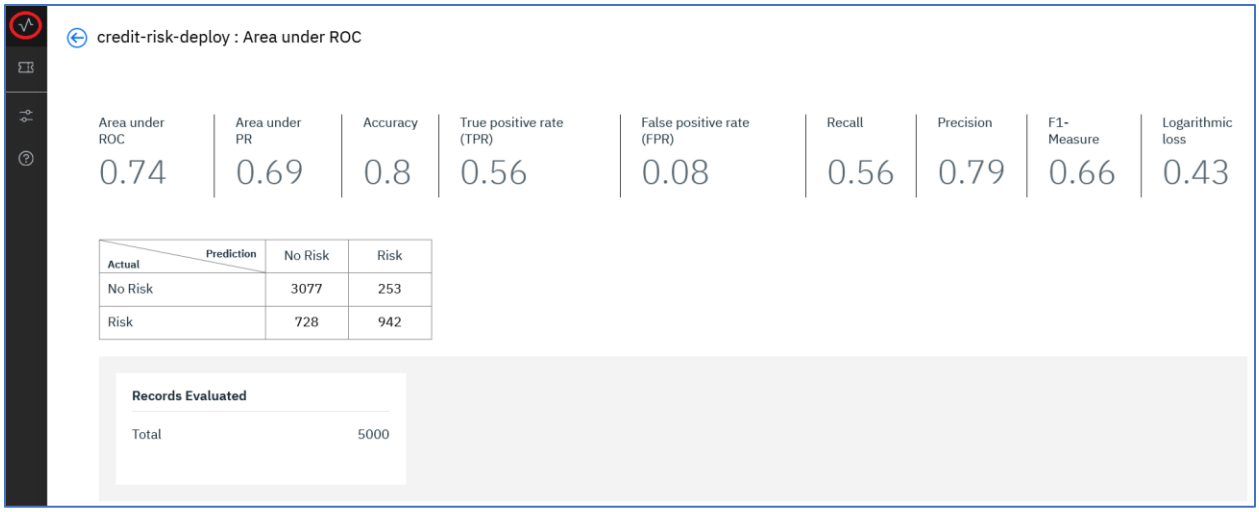


14. The screen is refreshed with the Area under ROC.

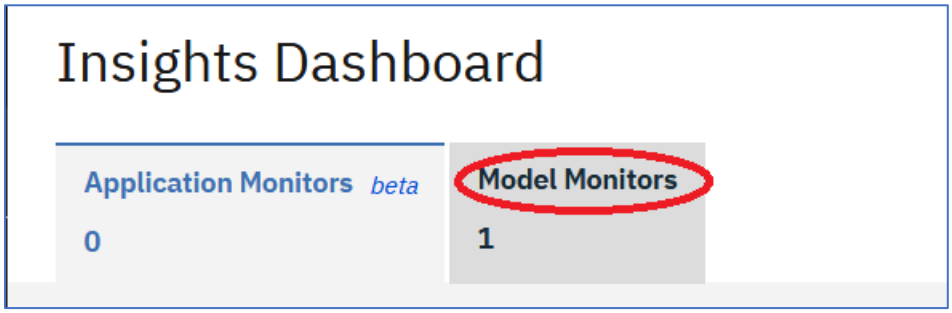
15. Click on the “red dot”.



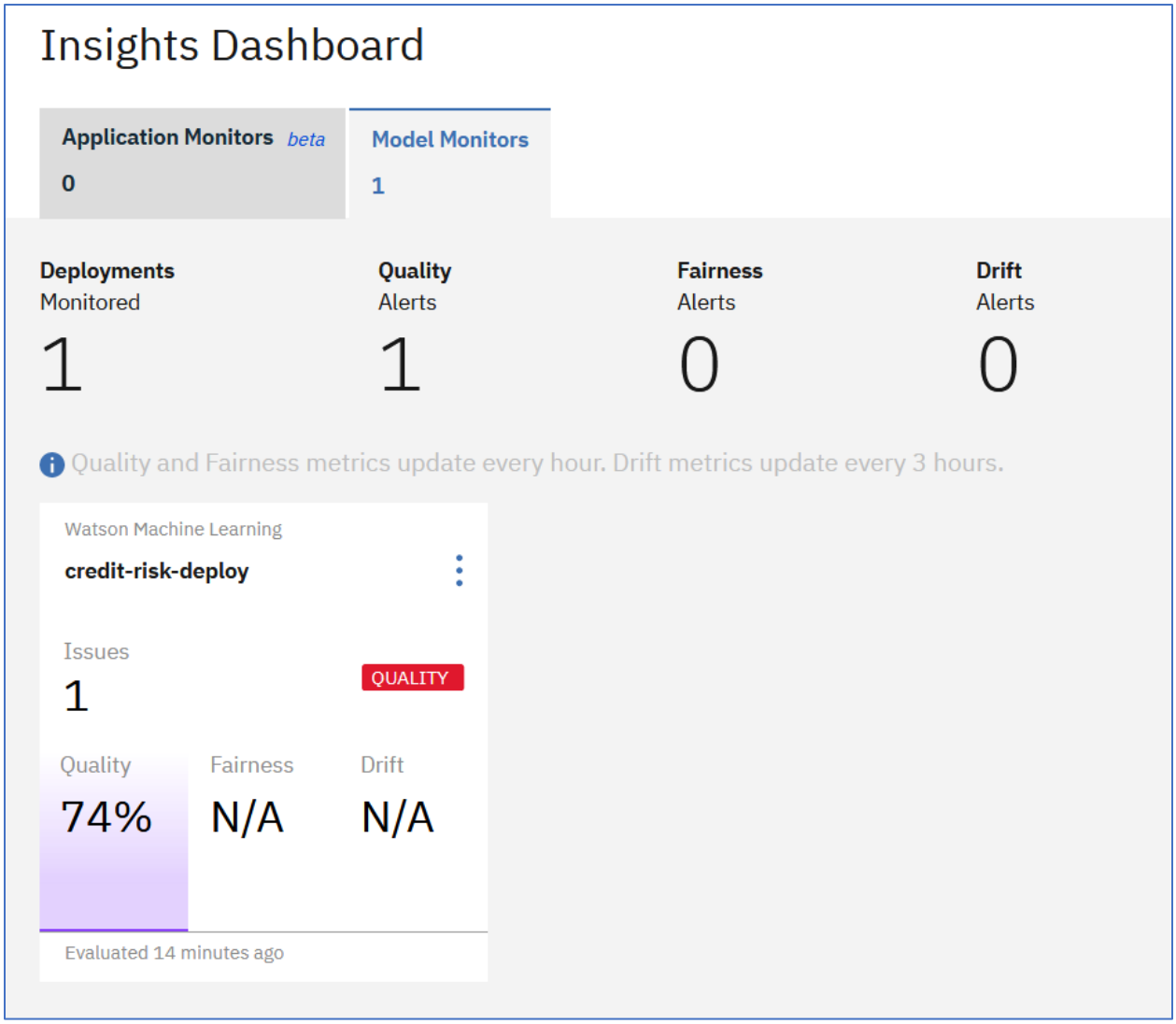
16. The metrics are displayed. Click on the  icon.



17. Click on **Model Monitors**.



18. The Insights Dashboard is displayed, showing the quality alert triggered by uploading the feedback data and checking quality.

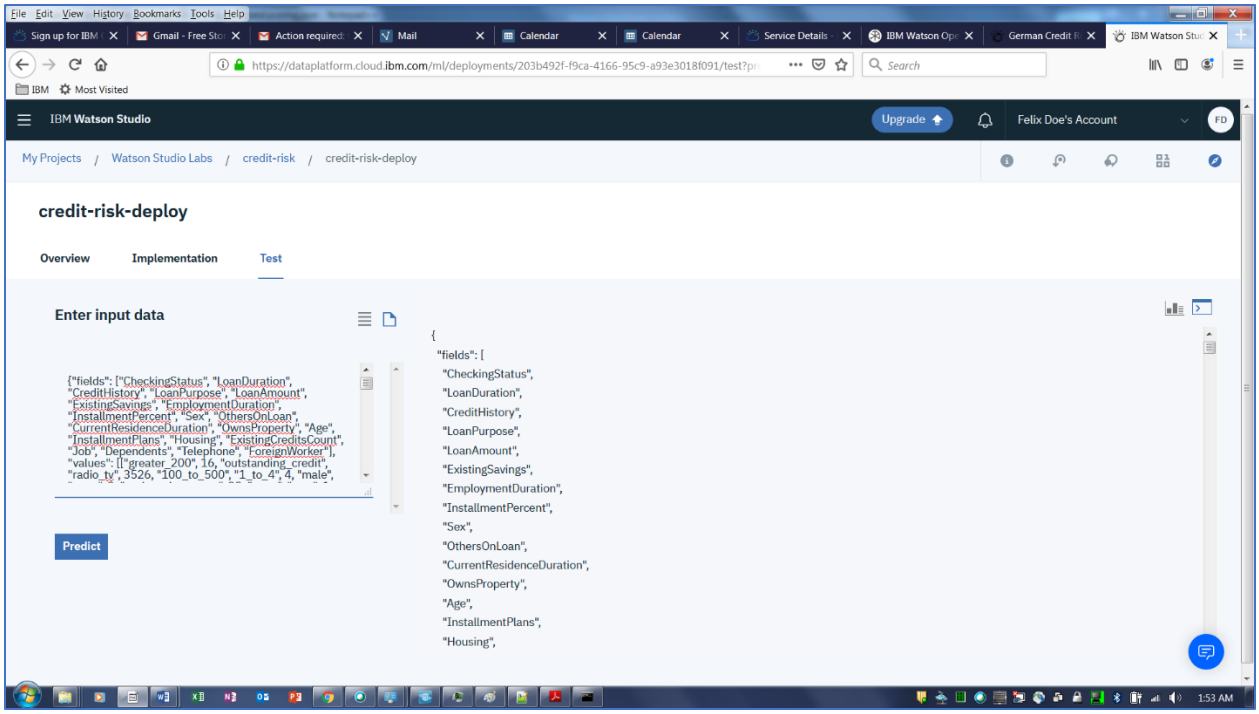


Score Transactions and View Fairness Metrics

In order to display Fairness metrics, we need to direct transactions to the deployed model. We will use the scoring.json file as sample data that Watson Studio will submit to the deployed model

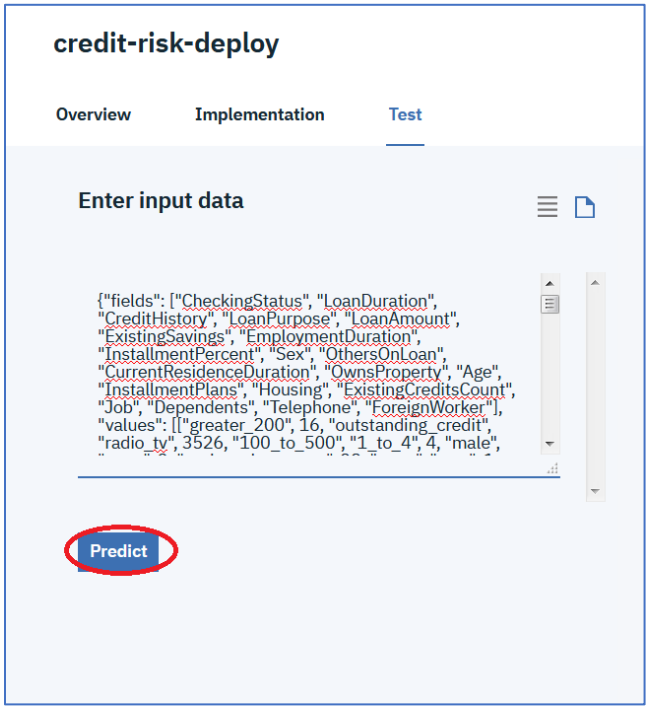
1. Return to Watson Studio by clicking on the **Watson Studio** browser tab.

2. You should be at the **Test** tab of the **credit-risk-deploy** page.

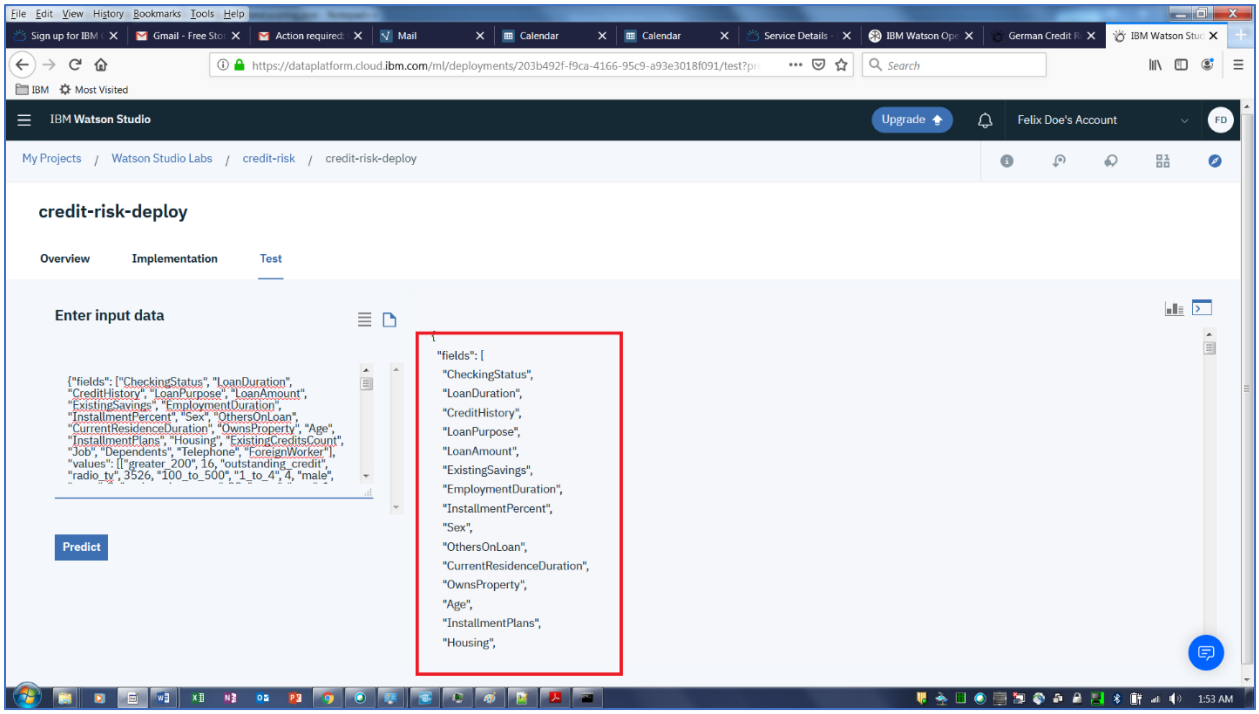


3. Clear out the contents of the **input data** area.
4. Navigate to where the scoring.json file and cut and paste the contents of the file into the **input data** area.

5. Click on **Predict**

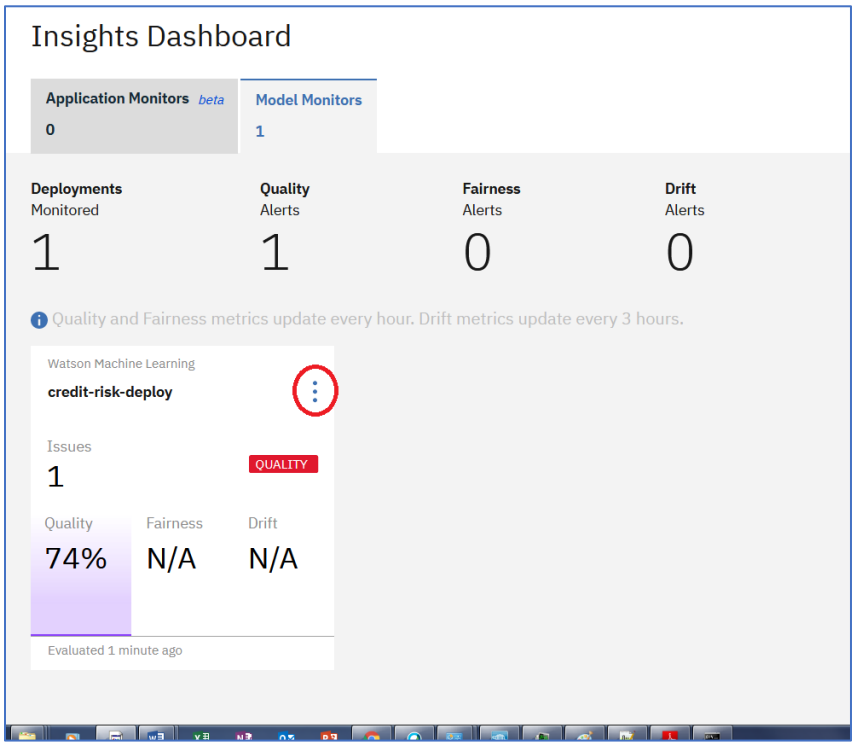


6. The result is displayed below.

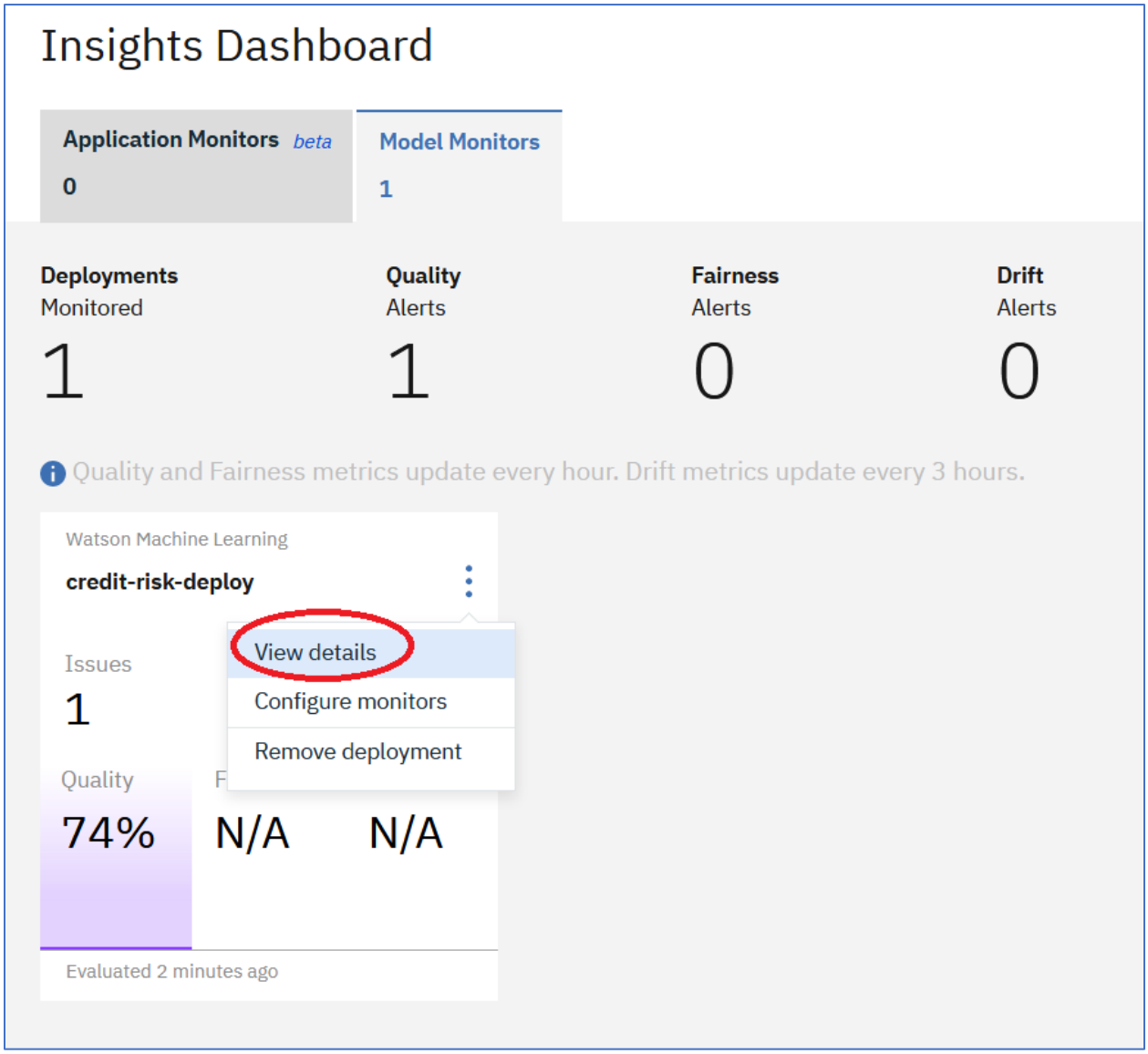


7. Click on the **Watson OpenScale** browser tab. 

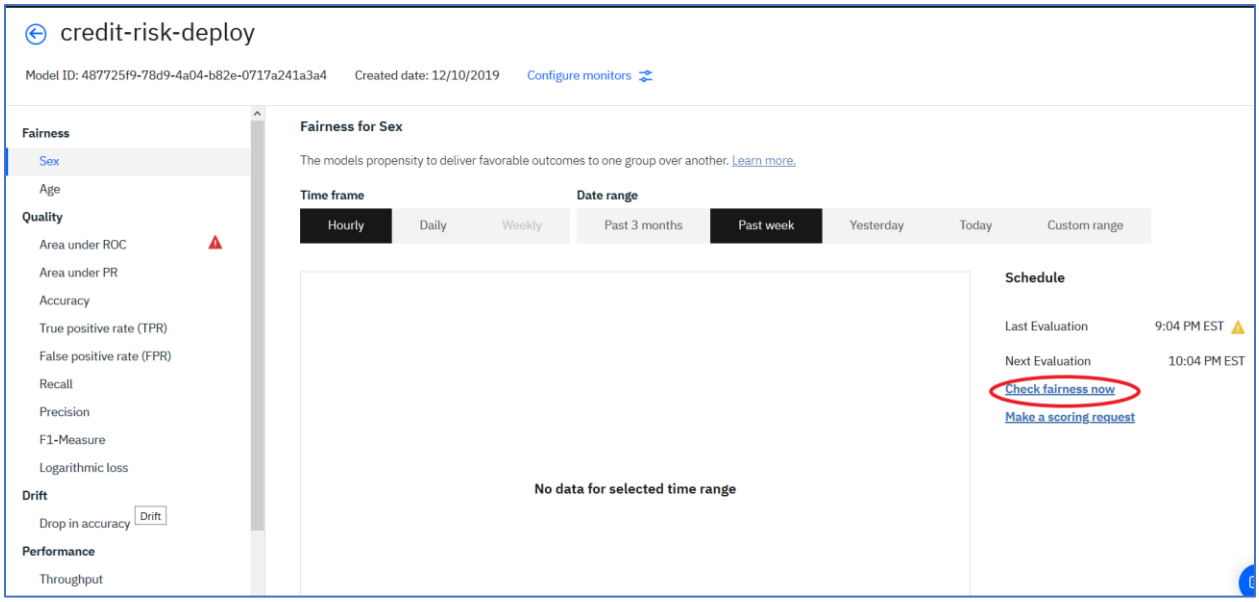
8. Click on the ⋮ icon.



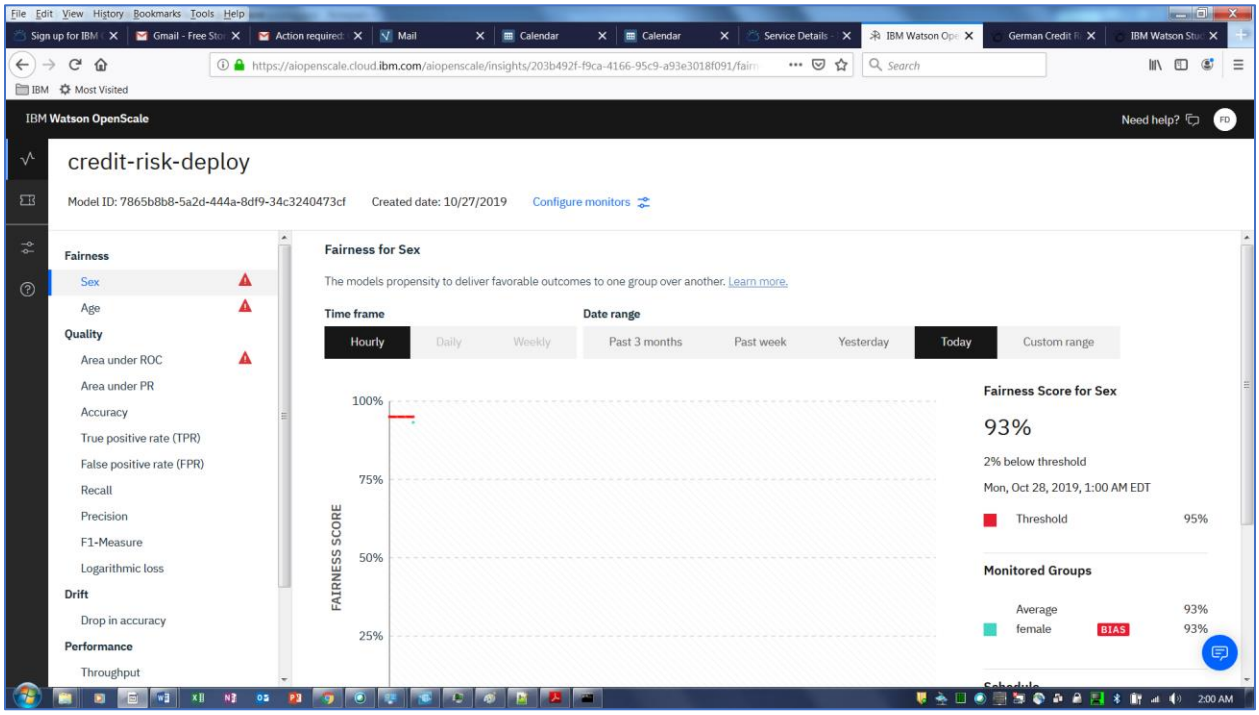
9. Click on **View details**.



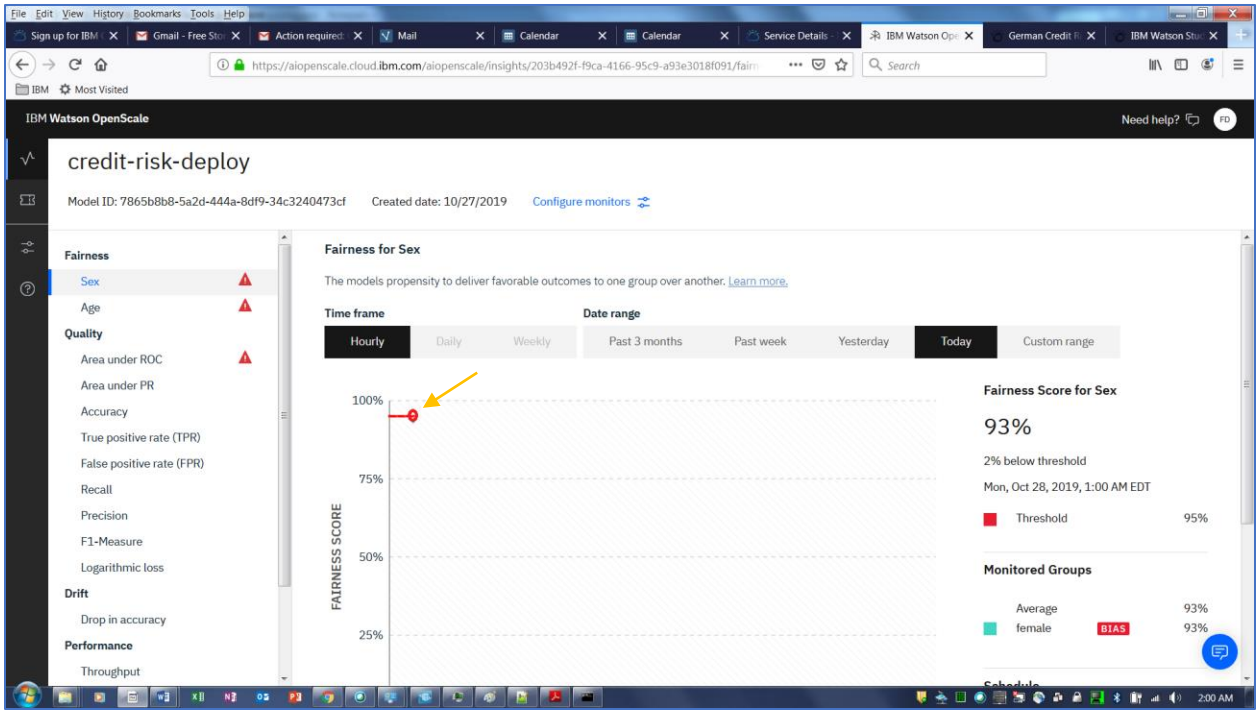
10. Click on **Check fairness now**.



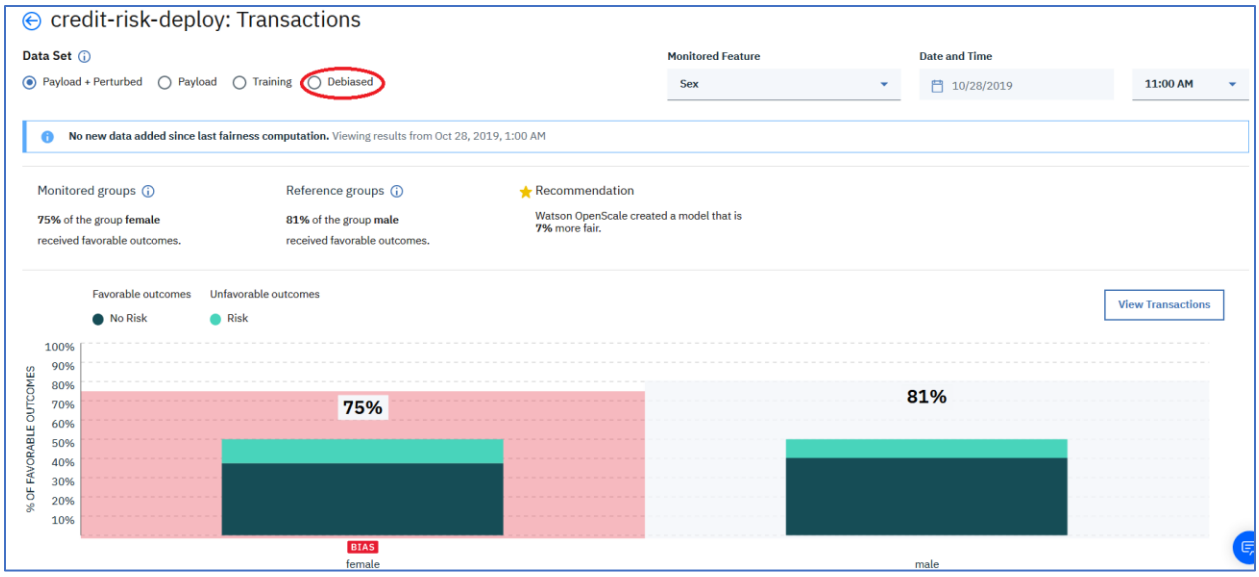
11. The Fairness score for sex is 2% below the threshold and triggers an alert.



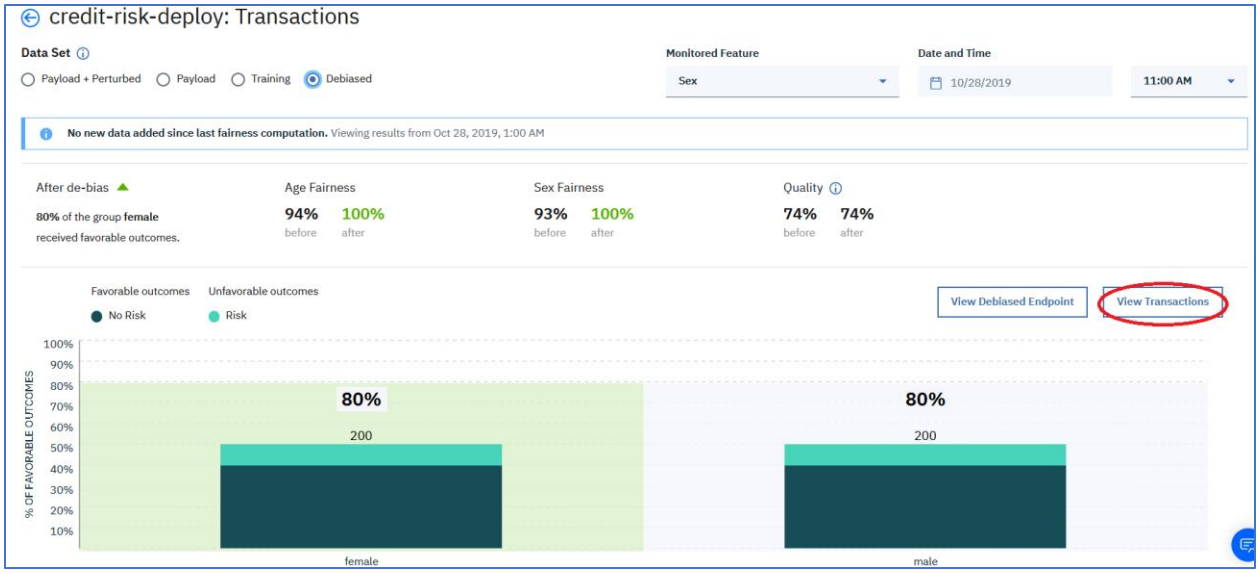
12. Click on the end of the timeline (should be a blue dot underneath) to view more details.



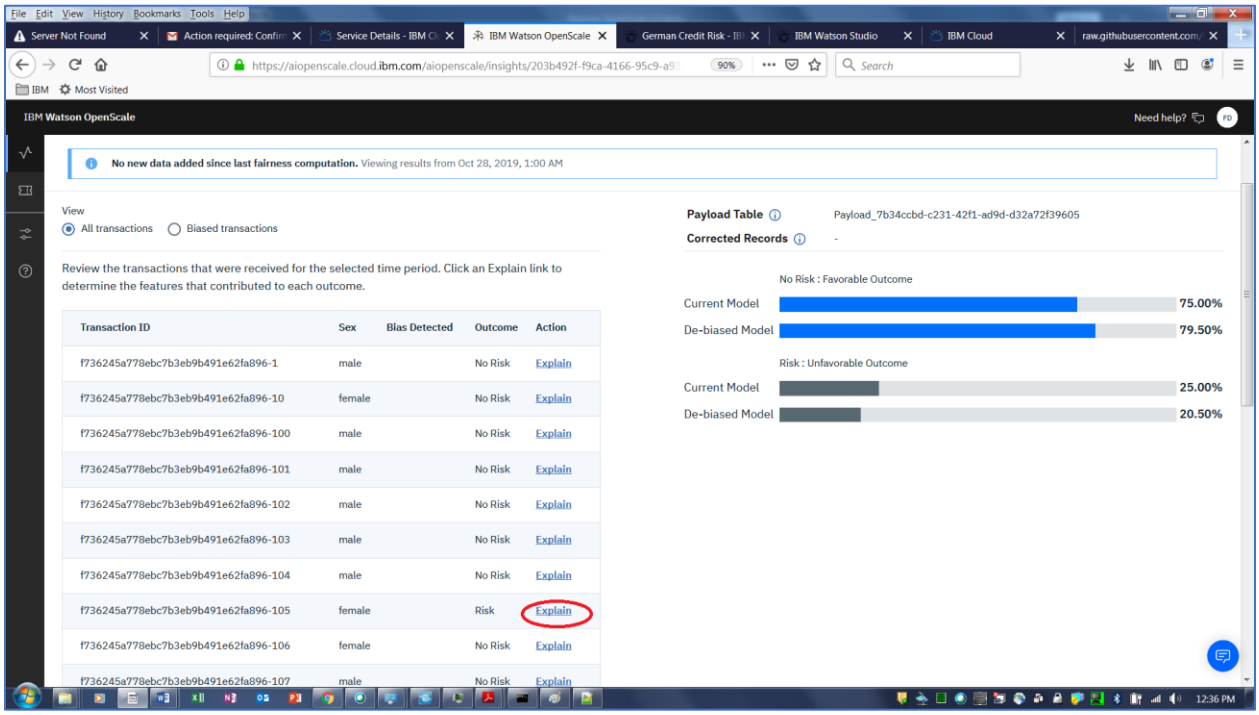
13. The discrepancy between Male and Female results are sufficient to trigger a bias alert. Click on **Debiased**.



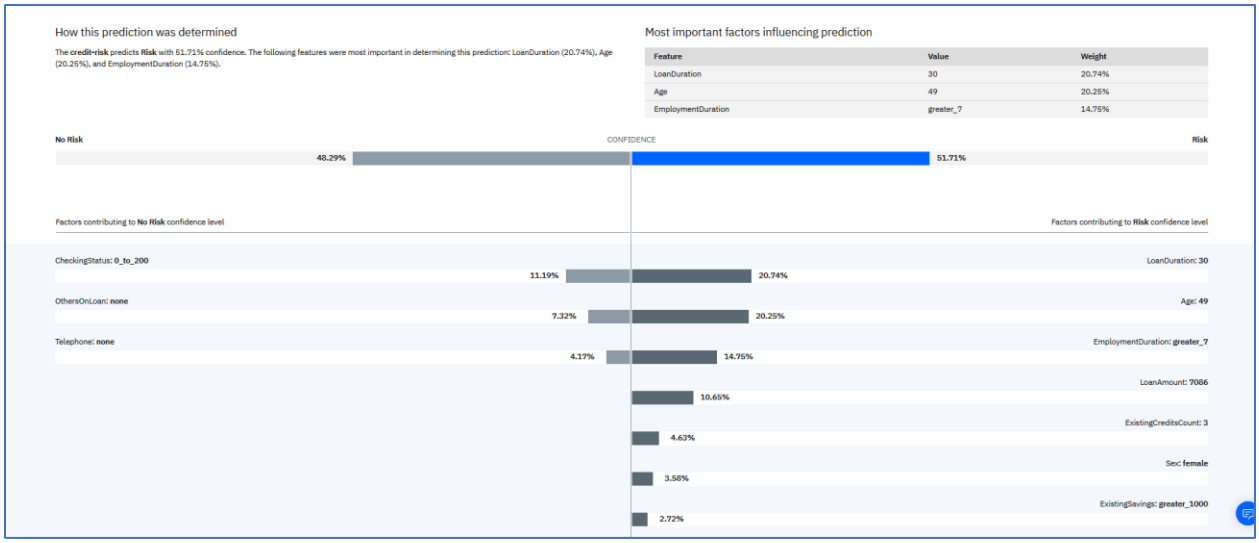
14. The results show that applying a debiasing scheme will reduce the bias to zero. The endpoint for invoking the debiasing algorithm can be obtained by clicking on View Debiased Endpoint. For now, click on **View Transaction** to display a list of transactions.



15. Click **Explain** next to a transaction to get an explanation of the factors that caused the deployed model to make the prediction it did for that transaction. I picked the first transaction that resulted in a Risk prediction.



16. The results show two ways of explaining the prediction. One is using a LIME approach that provides factors “for” and “against” the decision. The second method is called **Contrastive Explanation**. It provides the minimum changes in features that would result in a different decision. It also provides the maximum changes in features that would leave the result the same.



Congratulations! You have completed the Lab!!!

- ✓ Imported a machine learning model
- ✓ Deployed the model
- ✓ Provisioned Watson OpenScale
- ✓ Configured the payload logging database and Machine Learning provider
- ✓ Scored Data
- ✓ Prepared the Deployed Model for Monitoring
- ✓ Configured Payload Logging
- ✓ Configured Quality Monitoring
- ✓ Configured Fairness Monitoring
- ✓ Configured Drift Monitoring
- ✓ Submitted Feedback and Viewed Quality Metrics
- ✓ Scored Data and Viewed Fairness Metrics
- ✓ Explained a Transaction.