

# **Operating AI with Trust and Transparency**

Michael Cronk, IBM, michael.cronk@ibm.com

Bernard Beekman, IBM, beekmanb@us.ibm.com

## **Table of Contents**

Disclaimer .....	3
<b>Step 1: Create a Watson OpenScale service.</b> .....	<b>5</b>
<b>Step 2: Create a Watson Studio Project.....</b>	<b>6</b>
<b>Step 3: Set up Jupyter Notebooks and Configure Watson OpenScale.....</b>	<b>12</b>
<b>Step 4: Explore Watson OpenScale.....</b>	<b>20</b>
<b>Step 5: Synthesize a Neural Network. (Optional).....</b>	<b>31</b>

## **Disclaimer**

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision.

The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract.

The development, release, and timing of any future features or functionality described for our products remains at our sole discretion I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve results like those stated here.

Information in these presentations (including information relating to products that have not yet been announced by IBM) has been reviewed for accuracy as of the date of initial publication and could include unintentional technical or typographical errors. IBM shall have no responsibility to update this information. **This document is distributed "as is" without any warranty, either express or implied. In no event, shall IBM be liable for any damage arising from the use of this information, including but not limited to, loss of data, business interruption, loss of profit or loss of opportunity.** IBM products and services are warranted per the terms and conditions of the agreements under which they are provided.

IBM products are manufactured from new parts or new and used parts. In some cases, a product may not be new and may have been previously installed. Regardless, our warranty terms apply."

**Any statements regarding IBM's future direction, intent or product plans are subject to change or withdrawal without notice.**

Performance data contained herein was generally obtained in controlled, isolated environments. Customer examples are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual performance, cost, savings or other results in other operating environments may vary.

References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business.

Workshops, sessions and associated materials may have been prepared by independent session speakers, and do not necessarily reflect the views of IBM. All materials and discussions are provided for informational purposes only, and are neither intended to, nor shall constitute legal or other guidance or advice to any individual participant or their specific situation.

It is the customer's responsibility to insure its own compliance with legal requirements and to obtain advice of competent legal counsel as to the identification and interpretation of any relevant laws and regulatory requirements that may affect the customer's business and any actions the customer may need to take to comply with such laws. IBM does not provide legal

advice or represent or warrant that its services or products will ensure that the customer follows any law.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products about this publication and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. IBM does not warrant the quality of any third-party products, or the ability of any such third-party products to interoperate with IBM's products. **IBM expressly disclaims all warranties, expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a purpose.**

The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents, copyrights, trademarks or other intellectual property right.

IBM, the IBM logo, ibm.com and [names of other referenced IBM products and services used in the presentation] are trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at: [www.ibm.com/legal/copytrade.shtml](http://www.ibm.com/legal/copytrade.shtml).

© 2019 International Business Machines Corporation. No part of this document may be reproduced or transmitted in any form without written permission from IBM.

**U.S. Government Users Restricted Rights — use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM.**

## Step 1: Create a Watson OpenScale service.

1. Open up a new tab and access [bluemix.net](https://bluemix.net)
2. Click on Create resource.

The screenshot shows the IBM Cloud dashboard with the 'Create resource' button circled in red. The dashboard includes filters for Resource Group, Cloud Foundry Orgs, Cloud Foundry Space, Location, and Category, along with a search bar and account information.

3. Along the left side, click on AI.
4. Scroll down (if necessary) and click on Watson OpenScale.

The screenshot shows the AI service catalog with the 'Watson OpenScale' service circled in red. Other services listed include Watson Assistant, Compare and Comply, Discovery, Knowledge Catalog, Knowledge Studio, Language Translator, Machine Learning, Natural Language Understanding, Personality Insights, Speech to Text, Text to Speech, Tone Analyzer, Visual Recognition, and Watson Studio.

5. Once the Watson OpenScale page opens, keep the defaults and click Create.

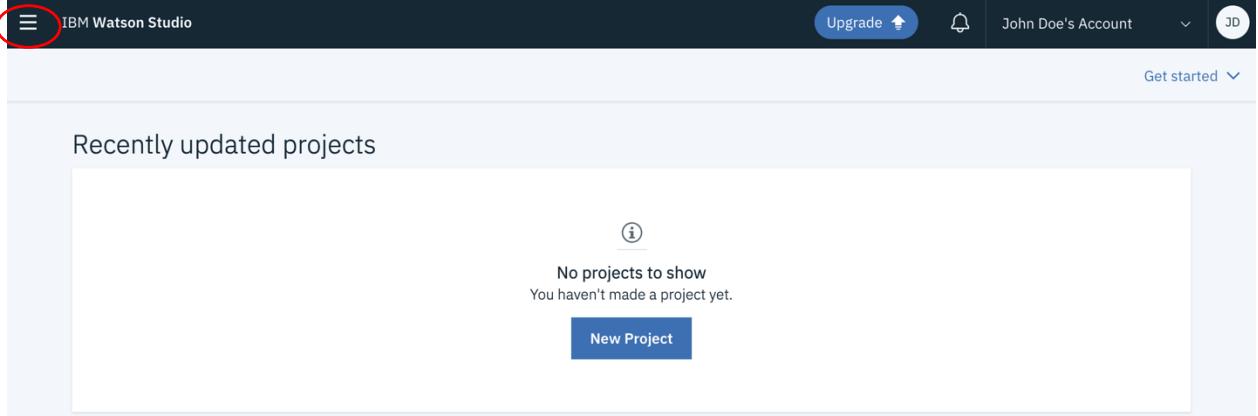
The screenshot shows the Watson OpenScale creation page. It includes fields for Service name (Watson OpenScale-xy), Choose a region/location to deploy in (Dallas), and Select a resource group (Default). The Features section lists several AI capabilities like Open, Bias detection and mitigation, Explainable AI recommendations, and NeuNetS - Neural Network Synthesis (Beta). The Images section shows placeholder text for image details. At the bottom, there are links for Need Help? and Estimate Monthly Cost, and a large blue 'Create' button circled in red.

## Step 2: Create a Watson Studio Project.

Watson OpenScale connects to a deployed machine learning model. We will use Watson Studio (a data science workbench) and Watson Machine Learning (a machine learning deployment engine). Note, Watson Machine Learning is not required to create and deploy a machine learning model for Watson OpenScale. OpenScale also supports Azure ML, AWS Sagemaker, as well as custom models.

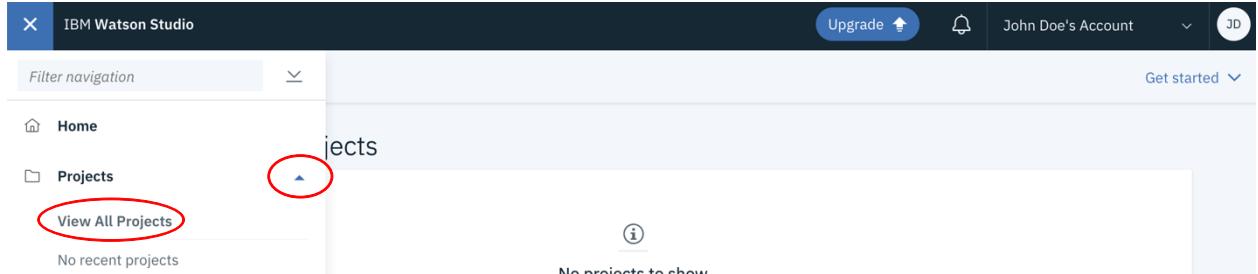
Before we begin, we need to create a Watson Studio Project. A Watson Studio Project is a collection of assets geared towards a specific data science goal. These assets can include machine learning models, runtimes, data files, and connections to 3<sup>rd</sup> party/open source databases.

1. Access [dataplateform.cloud.ibm.com](https://dataplatform.cloud.ibm.com).
2. Click on the Hamburger menu located in the top left of the screen.



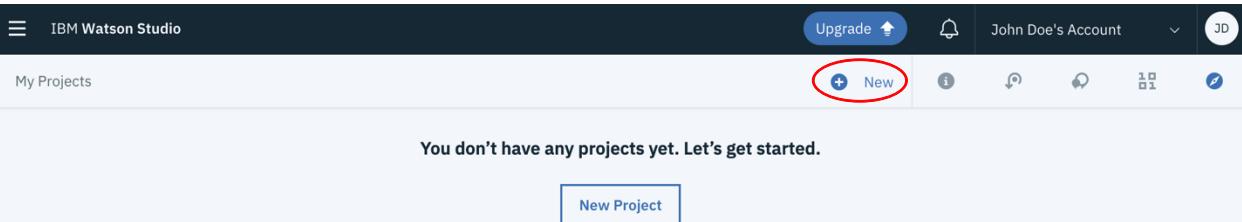
The screenshot shows the IBM Watson Studio interface. At the top, there's a dark header bar with the 'IBM Watson Studio' logo, an 'Upgrade' button, a notification bell, 'John Doe's Account', and a user icon. Below the header, a 'Get started' button is visible. The main content area is titled 'Recently updated projects'. It displays a message: 'No projects to show. You haven't made a project yet.' with an information icon. A blue 'New Project' button is centered below the message. The entire interface has a clean, modern design with a light gray background.

3. Click on Projects -> View all Projects.



This screenshot shows the 'Projects' section of the Watson Studio interface. On the left, a sidebar has 'Home' and 'Projects' sections. Under 'Projects', the 'View All Projects' link is highlighted with a red circle. The main content area shows a message: 'No recent projects' with an information icon. To the right, another message says 'No projects to show' with an information icon. The overall layout is consistent with the previous screenshot, featuring a dark header and a light gray body.

4. Click on New.



The screenshot shows the 'My Projects' section. At the top, there's a dark header bar with the 'IBM Watson Studio' logo, an 'Upgrade' button, a notification bell, 'John Doe's Account', and a user icon. Below the header, a 'New' button is highlighted with a red circle. The main content area displays a message: 'You don't have any projects yet. Let's get started.' with a 'New Project' button. The interface maintains its clean, modern aesthetic with a light gray background.

5. Click on Standard.

The screenshot shows the 'Create a project' interface. At the top, there's a navigation bar with 'IBM Watson Studio', 'Upgrade', 'John Doe's Account', and various icons. Below the bar, a back arrow and the text 'Create a project' are visible. A sub-section titled 'Standard' is highlighted with a red circle, showing a icon of two overlapping documents and the text 'Work with any type of asset. Add services for analytical assets as you need them.' Below this, a note says 'Choose the project starter for your work. Required services with Lite plans are provisioned automatically. You can add other assets and services later.'

6. Give your project a Name, a Description (optional), and click Create.

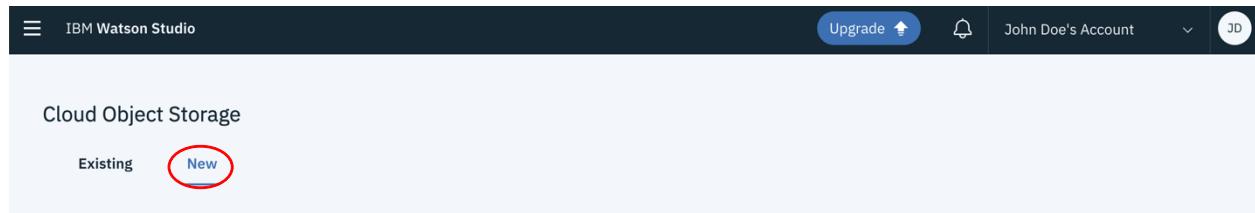
The screenshot shows the 'New project' creation screen. On the left, under 'Define project details', the 'Name' field contains 'Trusted AI Project' and the 'Description' field contains 'Trusted AI Demo'. Both fields are circled in red. On the right, under 'Define storage', there's a step-by-step guide: ① Select storage service (with an 'Add' button circled in red) and ② Refresh. Below the storage section, a note says 'Project will include integration with Cloud Object Storage for storing project assets.'

Cloud object storage is the default store for basic project assets. We will requisition a small instance for our project.

7. On the right side of the screen, click on Add under Define storage.

The screenshot shows the 'New project' creation screen again. The 'Define project details' section remains the same. In the 'Define storage' section, the 'Add' button under the 'Select storage service' step is circled in red. The rest of the interface is identical to the previous screenshot.

8. Click on New.



9. Scroll down, click on Lite, and click Create.

This screenshot shows the 'Create' page for Cloud Object Storage. It lists two service plans: 'Standard' and 'Lite'. The 'Lite' plan is selected, indicated by a red circle around the radio button. Below the plan selection, a note states: 'The Lite service plan for Cloud Object Storage includes Regional and Cross Regional resiliency, flexible data classes, and built in security.' At the bottom right, there are 'Cancel' and 'Create' buttons, with 'Create' also highlighted with a red circle.

9. Click on Confirm.

This screenshot shows a 'Confirm Creation' dialog box. It contains fields for 'Plan' (set to 'Lite'), 'Resource group' (set to 'Default'), and 'Service name' (set to 'cloud-object-storage-as'). At the bottom of the dialog are 'Cancel' and 'Confirm' buttons, with 'Confirm' highlighted with a red circle.

10. Once you are brought back to the New project page, click Refresh.

Define storage

- ① Select storage service

Add

Add an object storage instance and then return to this page and click Refresh.

- ② **Refresh**

The name of the storage service you have just created should appear under Storage.

Storage

cloud-object-storage-as

11. Click Create.

IBM Watson Studio

New project

Define project details

Name

Trusted AI Project

Description

Trusted AI Demo

Choose project options

Restrict who can be a collaborator i

Project will include integration with Cloud Object Storage for storing project assets.

Storage

cloud-object-storage-as

Create

12. Click on the Settings tab.

The screenshot shows the IBM Watson Studio dashboard. At the top, there's a navigation bar with 'IBM Watson Studio' and various account-related icons. Below it, a secondary navigation bar includes 'My Projects' and 'Trusted AI Project'. The main content area has several tabs: 'Overview', 'Assets', 'Environments', 'Bookmarks', 'Deployments', 'Access Control', and 'Settings'. The 'Settings' tab is circled in red.

13. Scroll down and click on Add a service for Associated services.

14. Click on Watson.

This screenshot shows the 'Associated services' section within the 'Storage' tab of the IBM Watson Studio interface. It includes a table with columns for NAME, SERVICE TYPE, PLAN, and ACTIONS. A modal window titled 'Add service' is open, listing various service options like Amazon EMR Spark, IBM Analytics Engine, Spark, Streaming Analytics, and Dashboard. The 'Watson' option is highlighted with a red circle.

15. Click on Add under Machine Learning.

This screenshot shows the 'Machine Learning' section. It features a circular icon with a brain-like pattern and the heading 'Machine Learning'. Below it is a descriptive text: 'IBM Watson Machine Learning - make smarter decisions, solve tough problems, and improve user outcomes'. A blue 'Add' button is located at the bottom left of the section, which is circled in red.

16. Ensure that the New tab is selected.

This screenshot shows the 'Machine Learning' interface. It has two tabs: 'Existing' and 'New'. The 'New' tab is highlighted with a red circle and has a blue underline, indicating it is the active tab.

**17. Scroll down and click on Lite.**

PLAN	FEATURES	PRICING
<input checked="" type="radio"/> Lite	<b>Service instance (5 models per instance)</b> 5,000 predictions 50 capacity unit-hours: Compute Tier: k80 = 2 capacity units for 1 training hour Compute Tier: k80x2 = 4 capacity units for 1 training hour Compute Tier: k80x4 = 8 capacity units for 1 training hour Otherwise 1 capacity unit for 1 computation hour Max 8 k80 GPUs (Deep Learning Training)	Free

The lite plan instance of the IBM Watson Machine Learning service provides you with a maximum of 5 deployed models, 5,000 predictions per month, and 50 capacity unit-hours per month during which model can be trained, evaluated, and deployed to be available to accept prediction events, with a minimum of 1 minute per training job.

**18. Click on Create.**

Compute Tier: v100 = 8 capacity units for 1 training hour  
Compute Tier: v100x2 = 16 capacity units for 1 training hour  
Otherwise 1 capacity unit for 1 computation hour  
HIPAA readiness option available in Dallas

**19. Keep the defaults and Click Confirm.**

X

Confirm Creation

**Region**  
US South

**Plan**  
Lite

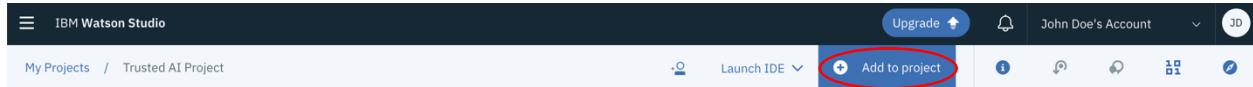
**Resource group**  
Default

**Service name**  
pm-20-zm

### Step 3: Set up Jupyter Notebooks and Configure Watson OpenScale.

A Jupyter Notebook is a self-contained environment that combines documentation and code. This allows us to walk through code and document each step. We will use one Jupyter Notebook to build and deploy a machine learning model and then configure OpenScale to monitor that deployed model. A second notebook will be used to automatically feed data to OpenScale to monitor for bias.

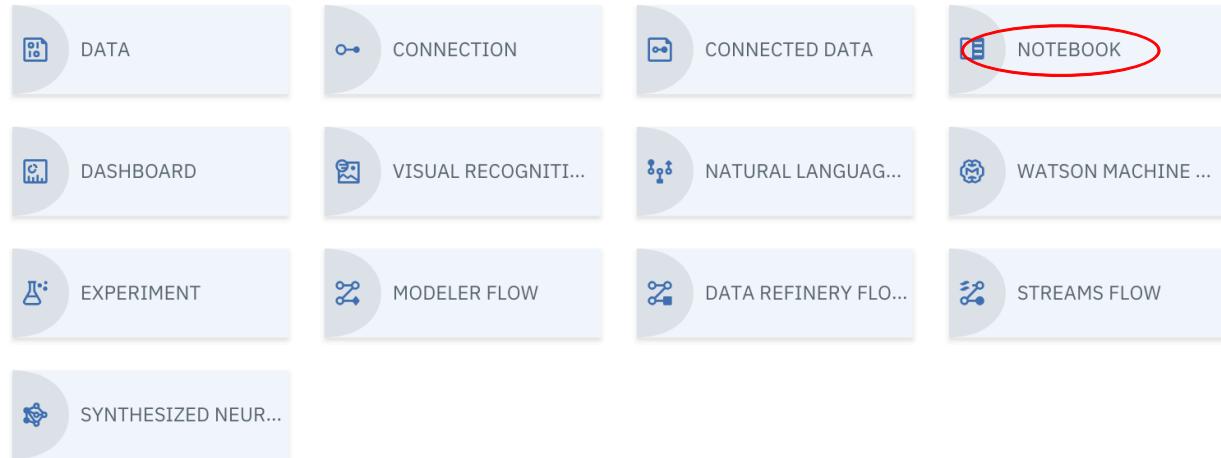
1. Click on Add to project.



2. Click on Notebook.

### Choose asset type

#### AVAILABLE ASSET TYPES



3. Click on the From URL tab.
4. Enter a Name and Description (optional) for your notebook.
5. Under Notebook URL, enter:

[https://raw.githubusercontent.com/cerebralace/WatsonPoT/master/Lab4/german\\_credit\\_lab.ipynb](https://raw.githubusercontent.com/cerebralace/WatsonPoT/master/Lab4/german_credit_lab.ipynb)

My Projects / Trusted AI Project / Add Notebook

### New notebook

Blank    From file    **From URL**

Name\*  
german\_credit\_lab  
33 Characters Remaining

Description  
Trusted AI demo  
485 Characters Remaining

Notebook URL\*  
[https://raw.githubusercontent.com/Mcronk/ThinkGov2019\\_Trusted/](https://raw.githubusercontent.com/Mcronk/ThinkGov2019_Trusted/)

Select runtime\* Includes notebook environments ⓘ  
Default Spark Python 3.5 XS (Driver with 1 vCPU and 4 GB RAM, 2 e)

The selected runtime uses one driver with 1 vCPU and 4 GB RAM, and 2 executors each with 1 vCPU and 4 GB RAM.  
This runtime consumes 1.5 capacity units per hour.  
[Learn more](#) about capacity unit hours and Watson Studio pricing plans.

6. Under Select runtime, click on the dropdown menu.

My Projects / Trusted AI Project / Add Notebook

### New notebook

Blank    From file    **From URL**

Name\*  
german\_credit\_lab  
33 Characters Remaining

Description  
Trusted AI demo  
485 Characters Remaining

Notebook URL\*  
[https://raw.githubusercontent.com/Mcronk/ThinkGov2019\\_Trusted/](https://raw.githubusercontent.com/Mcronk/ThinkGov2019_Trusted/)

Select runtime\* Includes notebook environments ⓘ  
**Default Spark Python 3.5 XS (Driver with 1 vCPU and 4 GB RAM, 2 e)**

The selected runtime uses one driver with 1 vCPU and 4 GB RAM, and 2 executors each with 1 vCPU and 4 GB RAM.  
This runtime consumes 1.5 capacity units per hour.  
[Learn more](#) about capacity unit hours and Watson Studio pricing plans.

7. Choose Default Spark Python 3.5 XS

Services  
Environments

- Default Spark Python 3.5 XS (Driver with 1 vCPU and 4 GB RAM, 2 executors with 1 vCPU and 4 GB RAM each)
  - Default Spark Scala 2.11 (Driver with 1 vCPU and 4 GB RAM, 2 executors with 1 vCPU and 4 GB RAM each)
  - Default Spark R 3.4 (Driver with 1 vCPU and 4 GB RAM, 2 executors with 1 vCPU and 4 GB RAM each)
  - Default Python 3.5 Free (1 vCPU and 4 GB RAM)
  - Default Python 3.5 XS (2 vCPU and 8 GB RAM)
  - Default Python 3.5 XS + Beta of DO (2 vCPU and 8 GB RAM)
  - Default R 3.4 XS (2 vCPU and 8 GB RAM)
  - Default Python 3.5 S (4 vCPU and 16 GB RAM)
  - Default R 3.4 S (4 vCPU and 16 GB RAM)

## 8. Click Create Notebook.

My Projects / Trusted AI Project / Add Notebook

New notebook

Blank   From file   From URL

<p>Name*</p> <input type="text" value="german_credit_lab"/> <p>33 Characters Remaining</p> <p>Description</p> <div style="border: 1px solid #ccc; padding: 5px;">Trusted AI demo</div> <p>485 Characters Remaining</p>	<p>Notebook URL*</p> <input type="text" value="https://raw.githubusercontent.com/Mcronk/ThinkGov2019_Trusted/"/> <p>Select runtime* Includes notebook environments ⓘ</p> <p>Default Spark Python 3.5 XS (Driver with 1 vCPU and 4 GB RAM, 2 e) ▾</p> <p>The selected runtime uses one driver with 1 vCPU and 4 GB RAM, and 2 executors each with 1 vCPU and 4 GB RAM. This runtime consumes 1.5 capacity units per hour. <a href="#">Learn more</a> about capacity unit hours and Watson Studio pricing plans.</p>
--	--

Cancel Create Notebook

Our notebook will create and deploy a machine learning model then configure Watson OpenScale and connect it to our cloud machine learning service. Before running our notebook, we need to enter credentials for the IBM Cloud API and our machine learning service.

9. Open up a new browser tab and access <https://cloud.ibm.com/iam#/users>

10. On the left side of the screen, click on IBM Cloud API keys.

The screenshot shows a navigation menu for 'Access (IAM)'. The 'Users' option is highlighted with a blue bar. Below it, there are links for 'Access groups', 'Service IDs', 'Authorizations', and 'IBM Cloud API keys'. The 'IBM Cloud API keys' link is circled in red.

11. Along the center of your screen, click on Create a Cloud API Key.

## IBM Cloud API Keys

Create and manage your IBM Cloud API keys. Service API keys are managed by the individual services.

[Create an IBM Cloud API key +](#)

12. Give the API key a name and click Create.

Create API key

The screenshot shows a 'Create API key' form. It has fields for 'Name' (containing 'Trusted AI lab Key') and 'Description'. At the bottom are 'Cancel' and 'Create' buttons, with 'Create' being circled in red.

13. Click on Copy.

API key successfully created

Copy the API key or click download to save it. You won't be able to see this API key again, so you can't retrieve it later.

API key

.....  
[Copy](#) [Download](#)

14. Back in your notebook under Provision service and configure credentials (next to CLOUD\_API\_KEY = , replace “PASTE HERE” with the key you just copied.

Your notebook should match the image below (with a different key between the quotes).

## Provision services and configure credentials

If you have not already, provision an instance of IBM Watson OpenScale using the [OpenScale link in the Cloud catalog](#).

Your Cloud API key can be generated by going to the [Users section of the Cloud console](#). From that page, click your name, scroll down to the API Keys section, and click **Create an IBM Cloud API key**. Give your key a name and click **Create**, then copy the created key and paste it below.

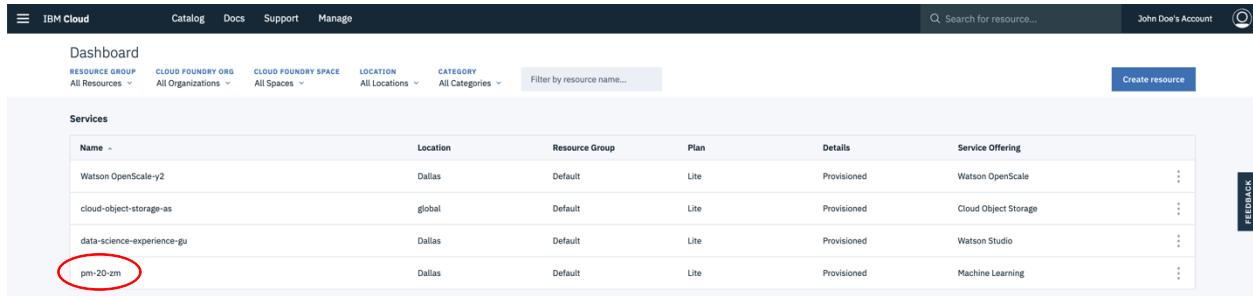
```
In [ ]: CLOUD_API_KEY = "qUi7SmU-CikqYrm3RIwXU_ofbJvJSh19DxmewRpY0dqx"
```

15. Open up a new browser tab and access [bluemix.net](http://bluemix.net)



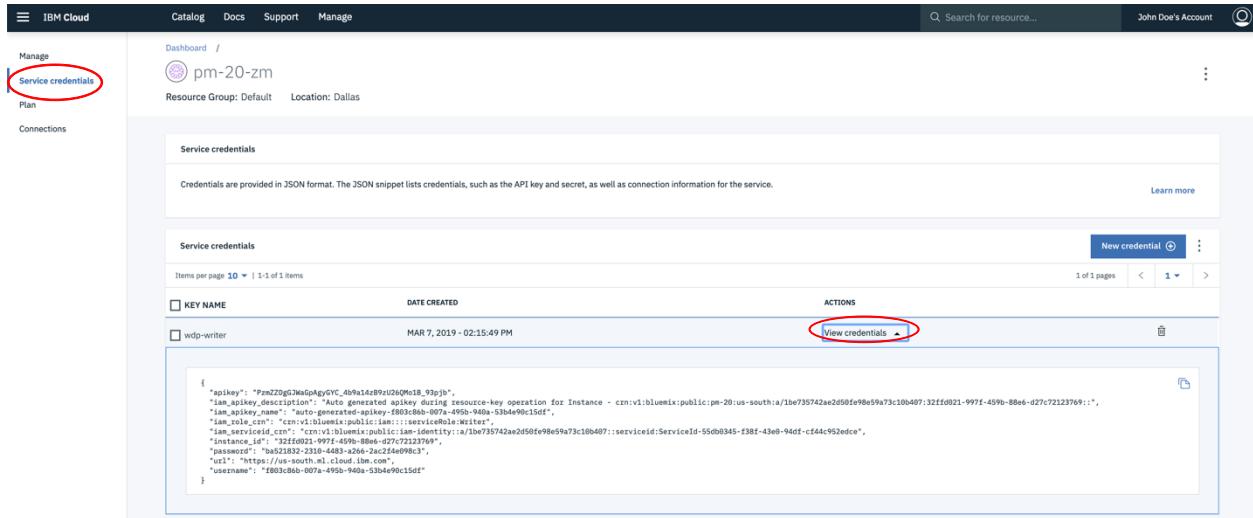
You will be brought to your dashboard page for Cloud resources.

16. Click on the Machine Learning service (the example in these instructions is called “pm-20-zm”



17. Click on Service Credentials along the left side.

18. Then click on View Credentials along the center.



19. Click on the pages icon to copy the credentials.

KEY NAME	DATE CREATED	ACTIONS
wdp-writer	MAR 7, 2019 - 02:15:49 PM	<a href="#">View credentials</a>

```
{
  "apikey": "PznZZ0g2MaGpAgvGV_C4b9a14zB9zU2qQW018_93pjb",
  "iam_apikey_description": "Auto generated apikey during :create:apikey operation for Instance - crn:v1:bluemix:public:pm-20:us-south:a/1be735742ae2d50fe98e59a73c10b40f:32ff0921-997f-459b-88e6-d27c72123769::",
  "iam_apikey_name": "auto-generated-apikey-f803c8d8-488a-48b6-53ba4e90c15df",
  "iam_crn": "crn:v1:bluemix:public:iam::::serviceRole:writer",
  "iam_serviceid_crn": "crn:v1:bluemix:public:iam:identity::a/b73735742ae2d50fe98e59a73c10b40f::servicedId:ServiceId-55db0345-f38f-43e9-94df-cf44c952edce",
  "instance_id": "32ff0921-997f-459b-88e6-d27c72123769",
  "password": "F803C8d8-007a-495b-940a-53ba4e90c15df",
  "url": "https://us-south.ml.cloud.ibm.com",
  "username": "f803c8d8-007a-495b-940a-53ba4e90c15df"
}
```

25. Back in your notebook, under Provision services and configure credentials, replace the WML\_CREDENTIALS = brackets with what you have just copied. WML stands for Watson Machine Learning.

## Provision services and configure credentials

If you have not already, provision an instance of IBM Watson OpenScale using the [OpenScale link in the Cloud console](#).

Your Cloud API key can be generated by going to the [Users section of the Cloud console](#). From that page, click **Create**, then copy the created key and paste it below.

```
In [ ]: CLOUD_API_KEY = "qUi7SmU-CikqYrm3RIwXU_ofbJvJSh19DxmewRpY0dqx"
```

Next you will need credentials for Watson Machine Learning. If you already have a WML instance, you may use those. Once your instance is created, click the **Service Credentials** link on the left side of the screen. Click the **New credentials** button. Copy and paste your WML credentials into the cell below.

```
In [ ]: WML_CREDENTIALS = {
    "apikey": "key",
    "iam_apikey_description": "description",
    "iam_apikey_name": "auto-generated-apikey",
    "iam_role_crn": "crn:v1:bluemix:public:iam::::serviceRole:Writer",
    "iam_serviceid_crn": "crn:v1:bluemix:public:iam:identity::",
    "instance_id": "instance_id",
    "password": "password",
    "url": "https://us-south.ml.cloud.ibm.com",
    "username": "username"
}
```

Your notebook should match the image below (with different credentials).

## Provision services and configure credentials

If you have not already, provision an instance of IBM Watson OpenScale using the [OpenScale link in the Cloud catalog](#)

Your Cloud API key can be generated by going to the [Users section of the Cloud console](#). From that page, click your **Create**, then copy the created key and paste it below.

```
In [ ]: CLOUD_API_KEY = "qUi7SmU-CikqYrm3RIwXU_ofbJvJSh19DxmewRpY0dqx"
```

Next you will need credentials for Watson Machine Learning. If you already have a WML instance, you may use credentials from that instance. Once your instance is created, click the **Service Credentials** link on the left side of the screen. Click the **New credentials** button. Copy and paste your WML credentials into the cell below.

```
In [ ]: WML_CREDENTIALS = {  
    "apikey": "PzmZZDgGJWaGpAgyGYC_4b9a14zB9zU26QMo1B_93pjB",  
    "iam_apikey_description": "Auto generated apikey during resource-key operation for Instance",  
    "iam_apikey_name": "auto-generated-apikey-f803c86b-007a-495b-940a-53b4e90c15df",  
    "iam_role_crn": "crn:v1:bluemix:public:iam::::serviceRole:Writer",  
    "iam_serviceid_crn": "crn:v1:bluemix:public:iam-identity::a/1be735742ae2d50fe98e59a73c10",  
    "instance_id": "32ffd021-997f-459b-88e6-d27c72123769",  
    "password": "ba521832-2310-4483-a266-2ac2f4e098c3",  
    "url": "https://us-south.ml.cloud.ibm.com",  
    "username": "f803c86b-007a-495b-940a-53b4e90c15df"  
}
```

Our notebook now has all the required credentials.

20. Select each cell in the notebook and hit SHIFT+ENTER to run.

Run your notebook cell by cell. Read through the notebook and observe the output. With the exception of the first cell installing packages, there should be no error output.

### Identify transactions for Explainability

Transaction IDs identified by the cells below can be copied and pasted into the Explainability tab of the OpenScale dashboard.

```
In [64]: payload_data = subscription.payload_logging.get_table_content(limit=60)
payload_data.filter(items=['scoring_id', 'predictedLabel', 'probability'])

Out[64]:
```

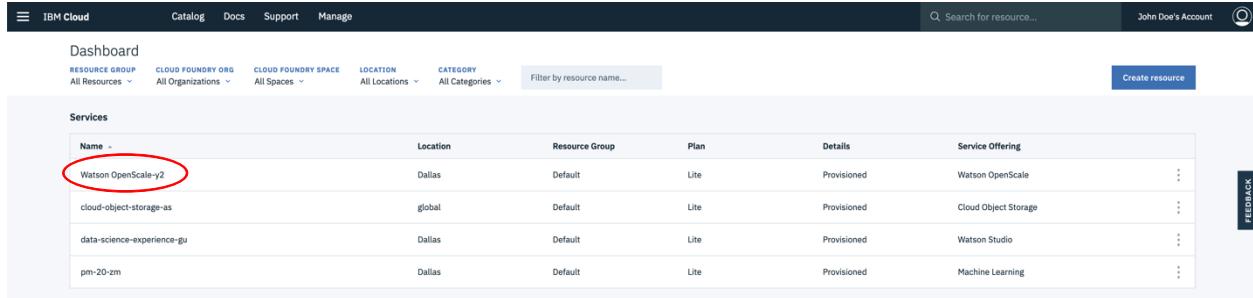
	scoring_id	predictedLabel	probability
0	e42459305c0c4dc185c6bc144d74806-423	No Risk	[0.8128085875806539, 0.18719141241934611]
1	e42459305c0c4dc185c6bc144d74806-567	No Risk	[0.9576935217341755, 0.0423064782658244]
2	e42459305c0c4dc185c6bc144d74806-951	No Risk	[0.9509147179413443, 0.04908528205865579]
3	e42459305c0c4dc185c6bc144d74806-663	No Risk	[0.9565610290260815, 0.04343897097391844]
4	e42459305c0c4dc185c6bc144d74806-424	No Risk	[0.81396200025809, 0.18603799974191007]
5	e42459305c0c4dc185c6bc144d74806-568	No Risk	[0.5729289479961321, 0.4270710520038678]
6	e42459305c0c4dc185c6bc144d74806-1	No Risk	[0.7093257286263136, 0.29067427137368634]
7	e42459305c0c4dc185c6bc144d74806-807	No Risk	[0.5765253746425008, 0.42347462535749925]
8	e42459305c0c4dc185c6bc144d74806-425	No Risk	[0.7136291870129947, 0.28637081298700523]
9	e42459305c0c4dc185c6bc144d74806-569	No Risk	[0.5485131522852063, 0.4514868477147938]
10	e42459305c0c4dc185c6bc144d74806-952	Risk	[0.09948668541411484, 0.9005133145858851]

Once the last cell has run successfully, continue with the steps below.

## Step 4: Explore Watson OpenScale.

For the purpose of this lab we have used notebooks to showcase the API and speed along the configuration process. For documentation and tutorials on manual configuration, please visit <https://cloud.ibm.com/docs/services/ai-openscale?topic=ai-openscale-crt-ov#crt-ov>

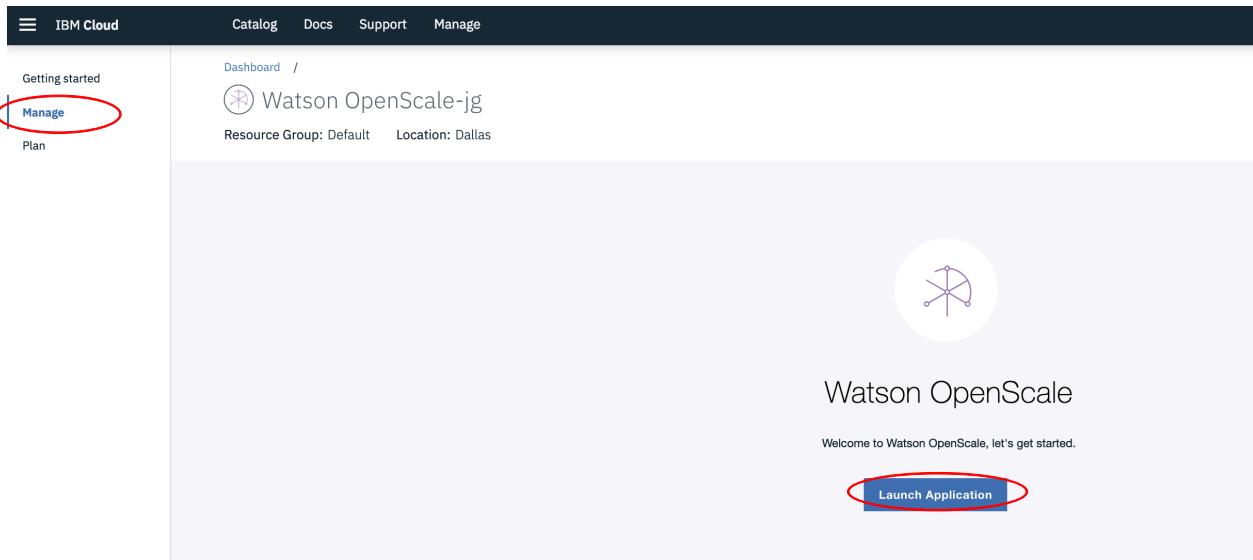
1. Return to <https://console.bluemix.net/dashboard/apps>
2. Click on the name of your Watson OpenScale service.



The screenshot shows the IBM Cloud dashboard. In the top navigation bar, the 'Manage' option is highlighted. Below the navigation, there are filters for RESOURCE GROUP, CLOUD FOUNDRY ORG, CLOUD FOUNDRY SPACE, LOCATION, and CATEGORY. A search bar says 'Search for resource...' and a 'Create resource' button is visible. The main area is titled 'Services' and contains a table with the following data:

Name	Location	Resource Group	Plan	Details	Service Offering
Watson OpenScale-y2	Dallas	Default	Lite	Provisioned	Watson OpenScale
cloud-object-storage-as	global	Default	Lite	Provisioned	Cloud Object Storage
data-science-experience-gu	Dallas	Default	Lite	Provisioned	Watson Studio
pm-20-zm	Dallas	Default	Lite	Provisioned	Machine Learning

3. Click on Manage along the bar on the left side.
4. Click on Launch Application.



The screenshot shows the Watson OpenScale application page. On the left sidebar, the 'Manage' option is highlighted with a red circle. The main content area shows the service name 'Watson OpenScale-jg' and details 'Resource Group: Default' and 'Location: Dallas'. A large circular icon with a stylized gear or compass symbol is centered. Below it, the text 'Watson OpenScale' is displayed. At the bottom, a blue button labeled 'Launch Application' is circled with a red line.

You will be brought to your Watson OpenScale dashboard. This is meant to show summary information on all models connected to this instance of Watson OpenScale. At a glance we are able to check all our models for accuracy, fairness, and if there is any bias detected.

5. Click on your model card.

The screenshot shows the IBM Watson OpenScale Insights dashboard. On the left is a dark sidebar with icons for navigation. The main area has a header "IBM Watson OpenScale" and a title "Insights". Below the title are three summary cards:

Deployments Monitored	Accuracy Alerts	Fairness Alerts
1	0	1

Below these cards is a detailed deployment card for "Spark German Risk Deployment...". The card has a red oval highlighting the title. It contains the following information:

- Issues:** 1 (with a red "BIAS" button)
- Accuracy:** 79%
- Fairness:** 91% (with a note: "1 of 2 attributes reported")
- Evaluated:** a few seconds ago

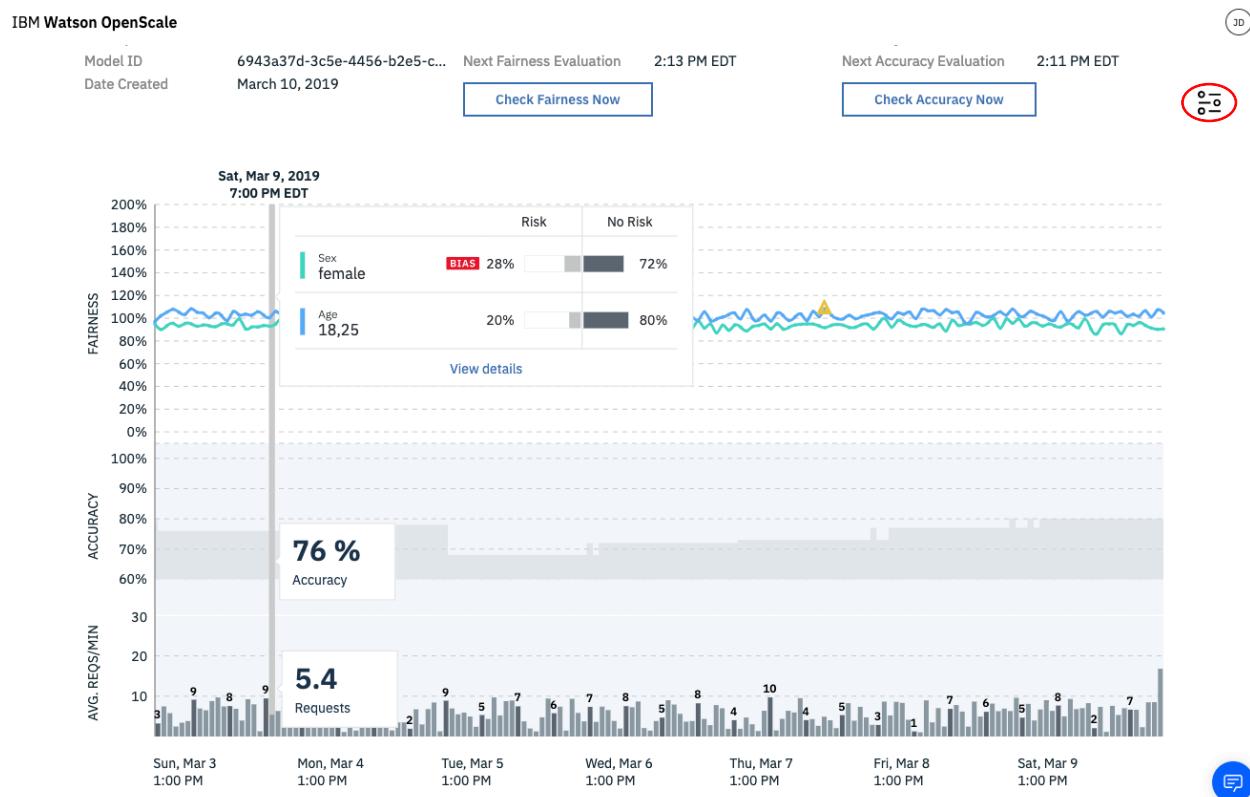
You will be brought to a model page.

The top of the screen shows model information and has buttons to immediately recalculate fairness and accuracy.

The screenshot shows the IBM Watson OpenScale interface. At the top, there's a sidebar with icons for checkmark, refresh, file, and help. The main title is "Spark German Risk Deployment - Final". Below the title, there are sections for "Description", "Model ID", and "Date Created". For "Description", it says "Fairness Evaluated 1:13 PM EDT" and "Next Fairness Evaluation 2:13 PM EDT". For "Model ID", it says "Accuracy Evaluated 1:11 PM EDT" and "Next Accuracy Evaluation 2:11 PM EDT". There are two blue buttons: "Check Fairness Now" and "Check Accuracy Now". On the far right, there's a circular icon with initials "JD" and a progress bar at 100%.

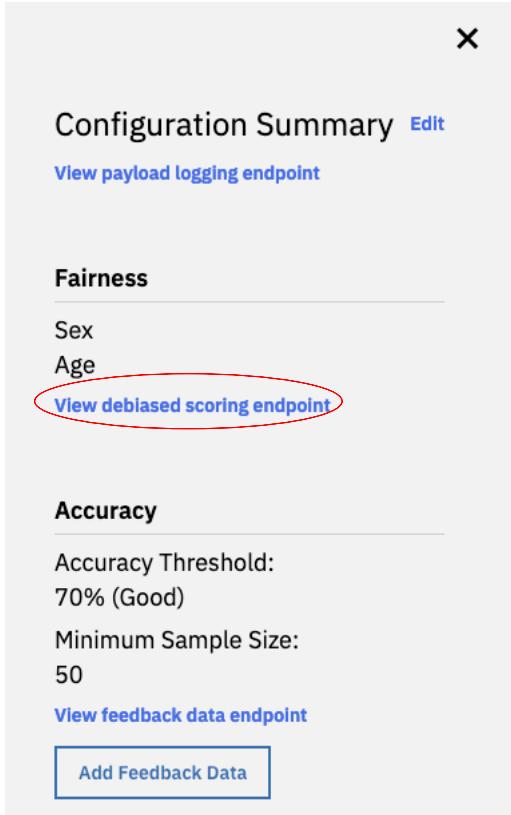
The lower half of the screen shows a time based graph tracking average requests per minute, accuracy, and fairness. Hovering over any part of the graph will allow you to drill down and see details for that set of transactions.

6. Click on the three dots to the far right of the screen.



A sidebar will open up that has links to manually configure Watson OpenScale fairness/bias thresholds and tracked features/inputs as well as links to the debiased scoring endpoint for your model.

7. Click on View debiased scoring endpoint.



This provides API specifications and calls for an endpoint that automatically mitigates any bias detected in your machine learning model. This allows external systems to use an unbiased version of a deployed machine learning model on a transaction by transaction basis.

8. Click on OK to return to your model graph.

IBM Watson OpenScale

JD

Spark German Risk Deployment - Final : Fairness

## Implementation of debiased scoring endpoint

Use the code snippet provided to get debiased responses from your deployed model.

[View API Specification](#) | [Download](#)

Deployment Name	Spark German Risk Deployment - Final
Datamart ID	90dacf5-5647-4a01-88e4-34631fc2c678
Feedback Table Name	Feedback_6943a37d-3c5e-4456-b2e5-ccc45ed4eb09
Deployment ID	eb12030e-73ec-4c5e-bb7e-91772bba10c5
Subscription ID	6943a37d-3c5e-4456-b2e5-ccc45ed4eb09
Binding ID	a04620c8-926c-480c-9e8f-563e74c4481a

Debiased Endpoint Code Snippet: Spark German Risk Deployment - Final [ⓘ](#)

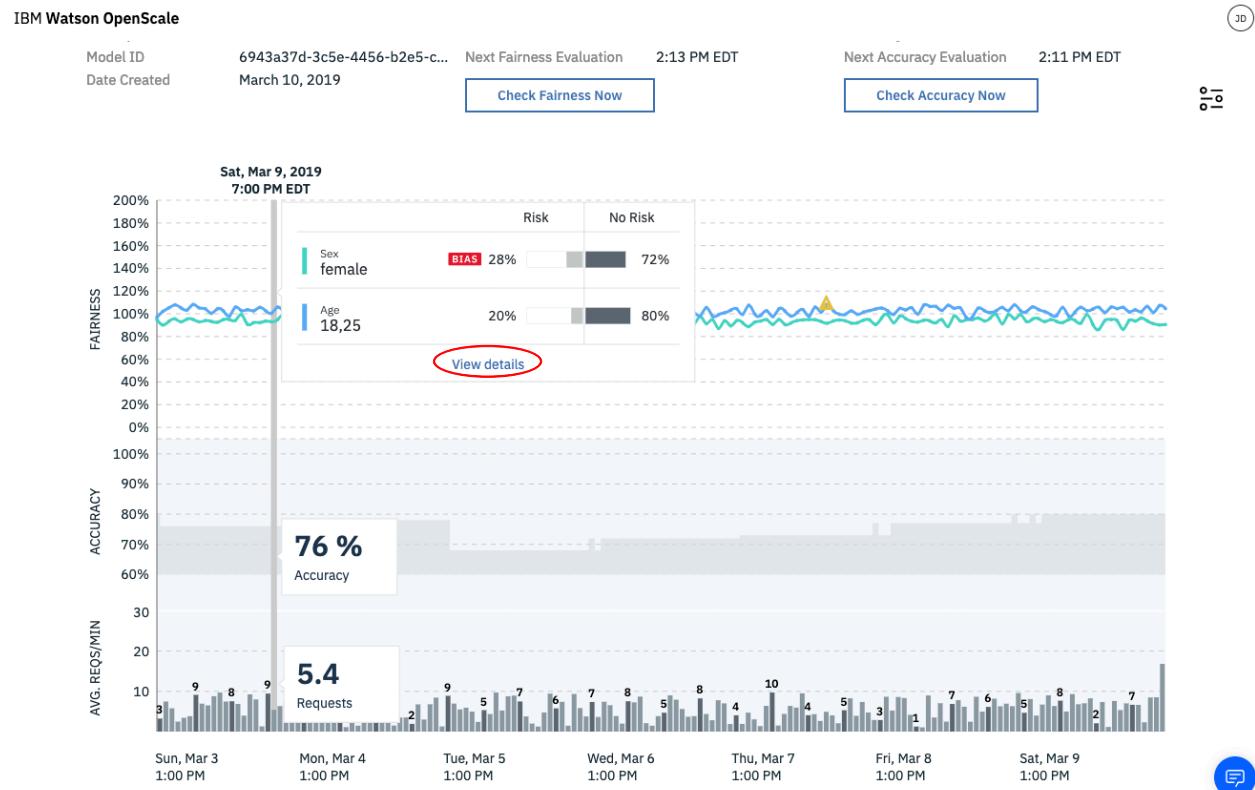
[cURL](#)    [Java](#)    [Python](#)

[Copy to clipboard](#)

```
# Replace "fields" - list of features column from payload logging - replace sample values with proper ones
# Replace "values" - payload logging data records - replace sample values with proper ones
curl -X POST "https://api.aiopenscale.cloud.ibm.com/v1/data_marts/90dacf5-5647-4a01-88e4-34631fc2c678/service_bindings/a04620c8-926c-480c-9e8f-5
```

OK

9. Hover over a more recent transaction and click View details.



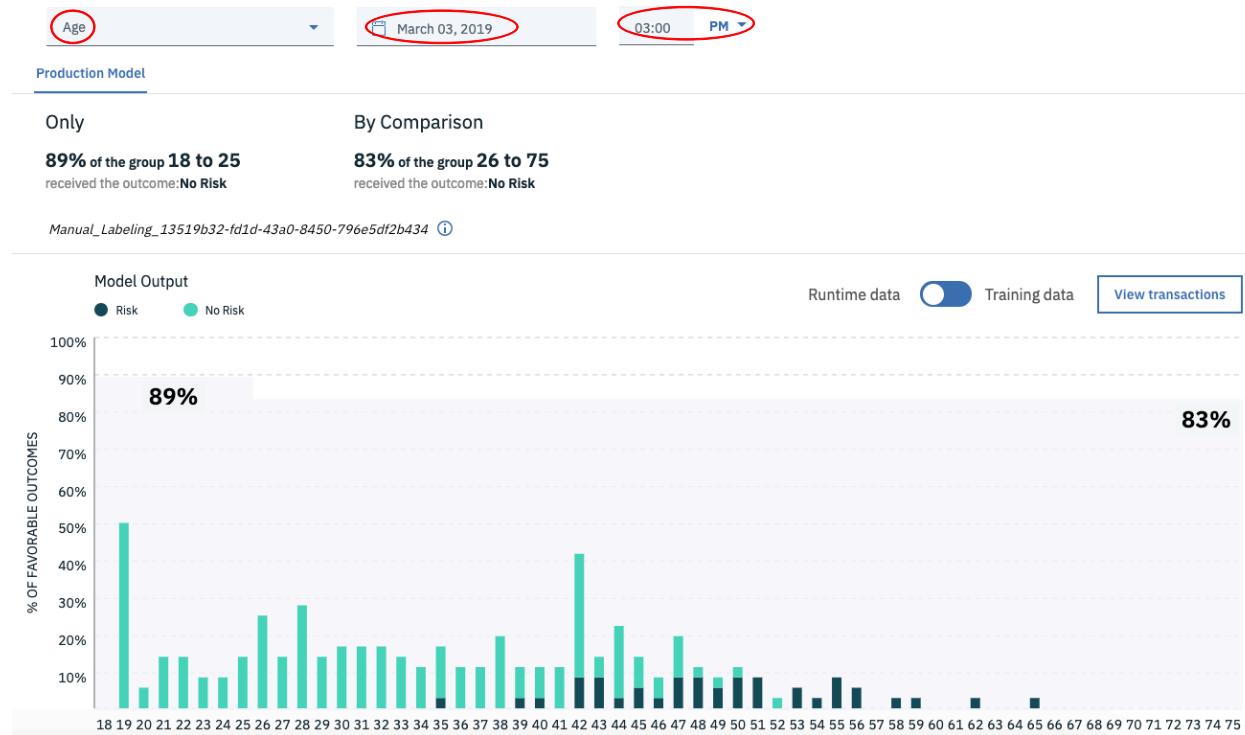
This page allows us to focus on fairness for a specific input feature (in this case we have set OpenScale to track the fairness of Age and Sex). Favorable outcomes were also set by our notebook with No Risk as the favorable outcome. A threshold can be configured to flag bias if fairness falls below that threshold.

Note that it may take 15 minutes time for the de-biased model to appear the first time.

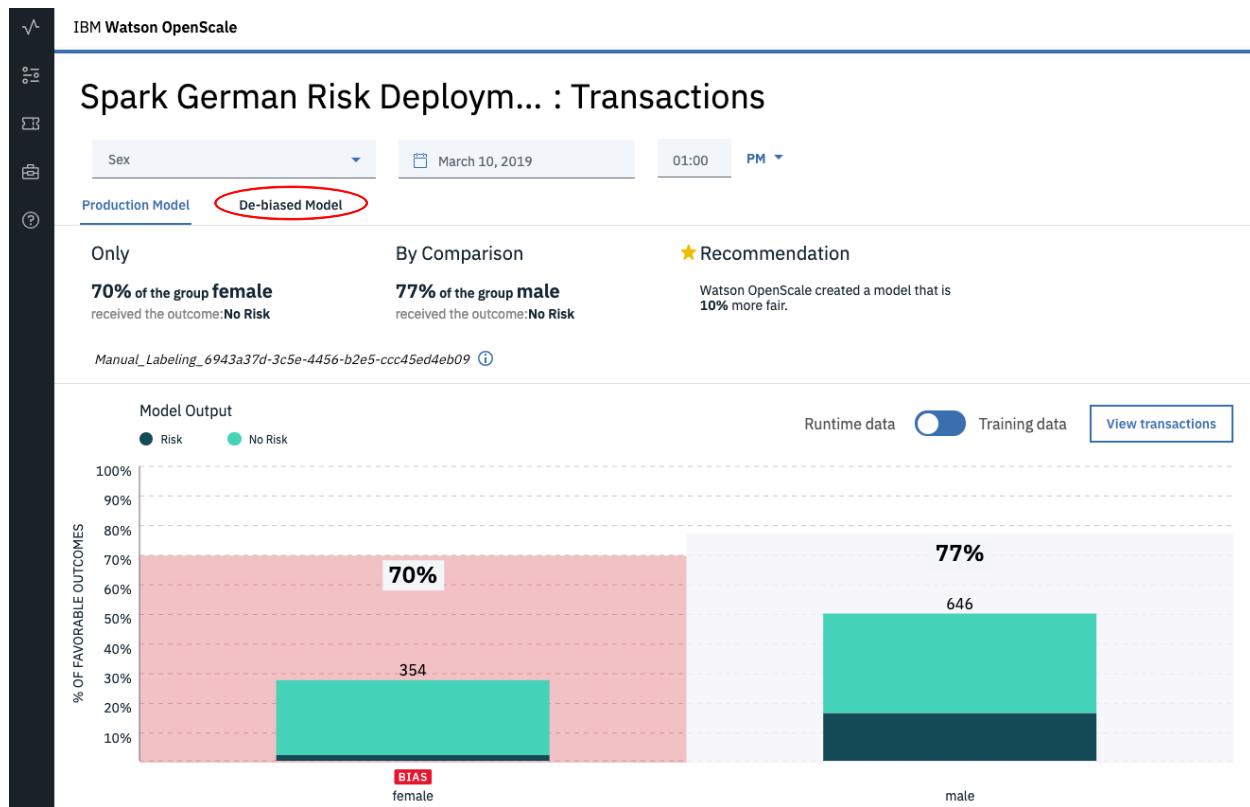
10. After waiting for 15 minutes, change Age to Sex.

11. Switch the date and time as close as possible to your current day and time.

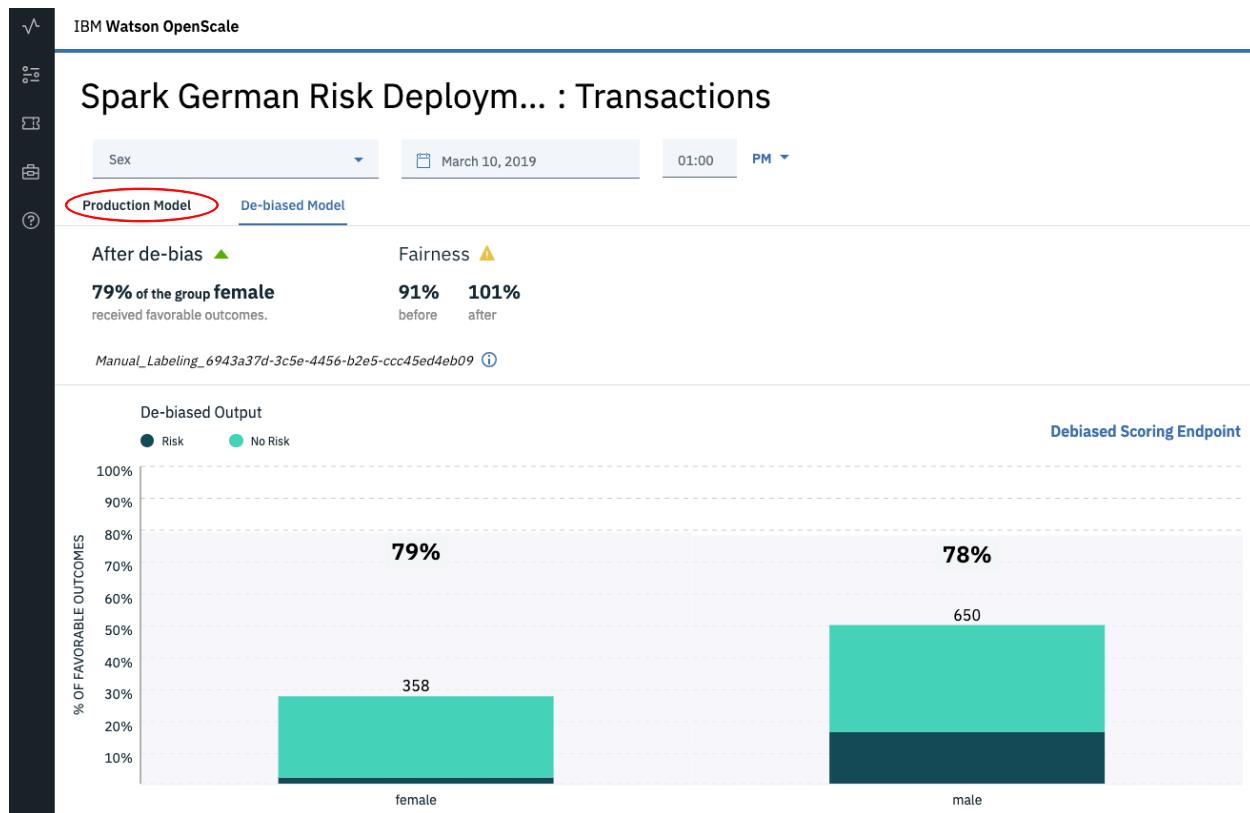
## Spark German Risk Deploym... : Transactions



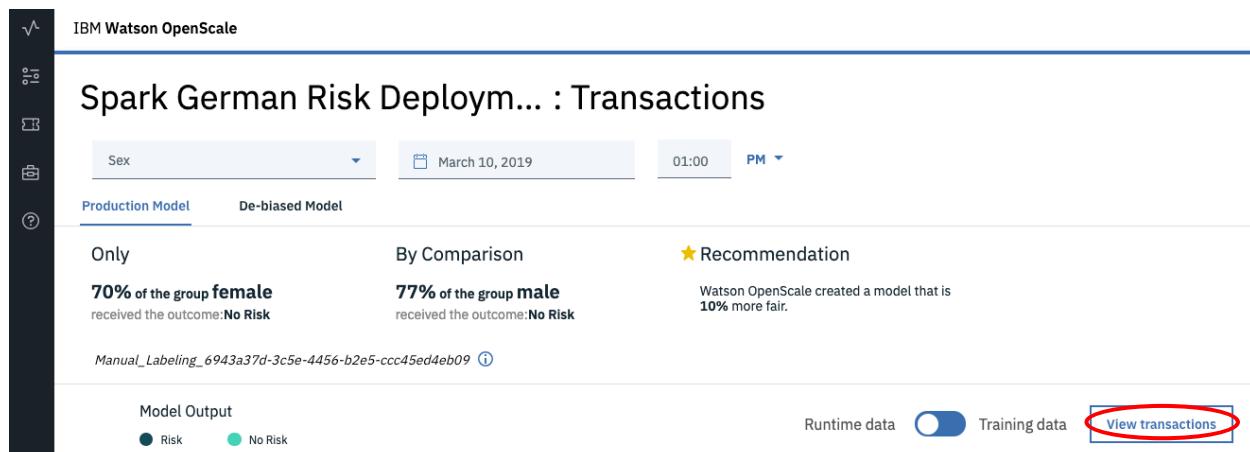
12. Switch to the De-biased model tab to observe the model OpenScale created to mitigate bias.



13. Once you have observed the change, click on the Production Model tab.



14. Click on View transactions.



This page allows us to observe transaction-by-transaction lists on the left side of the screen and aggregate Payloads on the right with comparisons between the current model and de-biased models.

15. Click on Explain next to a transaction.

IBM Watson OpenScale

## Spark German Risk Deployment - Final: Transactions

March 10, 2019 01:00 PM

Sex

View  
 All transactions  Biased transactions

Payload Table Corrected Records

Payload\_6943a37d-3c5e-4456-b2e5-ccc45ed4eb09

TRANSACTION ID	SEX	BIAS DETECTED	OUTCOME	ACTION
c304f74f62cc1193c6747c3c6eb1d7c0-159	female	0	0	<a href="#">Explain</a>
c304f74f62cc1193c6747c3c6eb1d7c0-1	male	0	0	<a href="#">Explain</a>
c304f74f62cc1193c6747c3c6eb1d7c0-160	male	1	1	<a href="#">Explain</a>
c304f74f62cc1193c6747c3c6eb1d7c0-22	female	0	0	<a href="#">Explain</a>
c304f74f62cc1193c6747c3c6eb1d7c0-161	female	1	1	<a href="#">Explain</a>

No Risk : Favorable Outcome

Current Model		69.9%
De-biased Model		79.3%

Risk : Unfavorable Outcome

Current Model		30.1%
De-biased Model		20.7%

This shows how our model made a decision based on how different input features were weighted and lists the minimum changes necessary to switch the model decision.

IBM Watson OpenScale

### Explain a transaction

f6346cb26edf4fc10b4...

Details 1

Transaction	f6346cb26edf4fc10b45a8cea4e7a4ad-930	Minimum factors supporting this outcome <small>1</small>
Deployment	Spark German Risk Deployment - Final	LoanDuration 43
Model Name	Spark German Risk Model - Final	InstallmentPlans bank
		Job unemployed

Risk CONFIDENCE No Risk

45%		55%	
-----	--	-----	--

Factors contributing to **Risk** confidence level

Factors contributing to **No Risk** confidence level

LoanDuration: 43.00	25%		11%		OthersOnLoan: none
---------------------	-----	--	-----	--	--------------------

**You have completed base lab.**

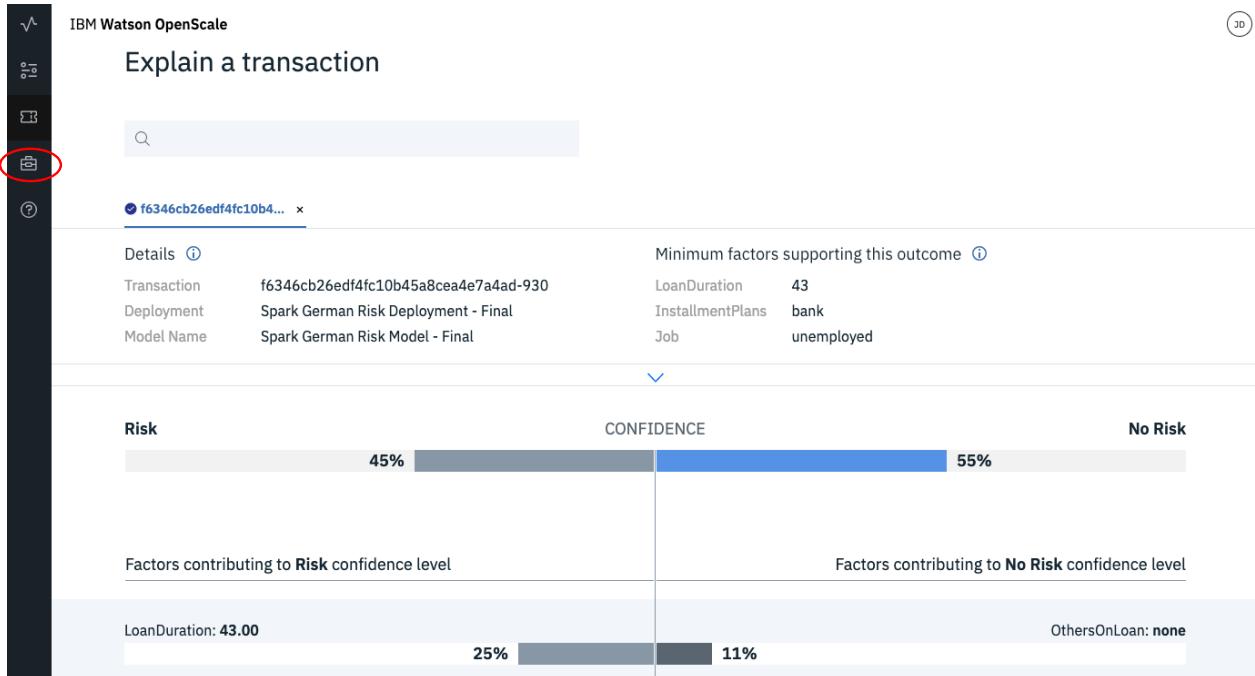
**For training on topics including machine learning, data science, and blockchain, please visit: <https://www.ibm.com/industries/federal/analytics>**

**For an additional optional lab, continue on to step 4 on the next page.**

## Step 5: Synthesize a Neural Network. (Optional)

Watson OpenScale and Watson Studio are able to automatically synthesize Neural Networks with a high a degree of performance.

1. Click on the briefcase icon.



The screenshot shows the IBM Watson OpenScale interface. On the left, there's a sidebar with icons for settings, search, and a briefcase (which is circled in red). The main area is titled "Explain a transaction". It shows a transaction ID (f6346cb26edf4fc10b45a8cea4e7a4ad-930) and details about the deployment and model name. Below this, a risk confidence bar shows 45% for Risk and 55% for No Risk. At the bottom, it lists factors contributing to these levels: LoanDuration: 43.00 (25%) and OthersOnLoan: none (11%).

2. Click on Synthesize a model.

Try NeuNetS

NeuNetS (beta) allows you to synthesize models using Watson OpenScale technology in Watson Studio.

[Sign up for the free Watson Studio Lite plan](#)



3. Click on Synthesize a model.

The screenshot shows the 'NeuNetS : Neural Network Synthesis BETA' page. At the top, there are two main sections: '1 Upload your data' and '2 NeuNetS does the rest'. Below these sections, there is a 'Getting Started' area with a 'Synthesize a Model' button, which is circled in red. There is also a 'View Documentation' link.

4. Under Trained model connection, click Select.

The screenshot shows the 'Define classifier details' section on the left and the 'Trained model connection' section on the right. In the 'Trained model connection' section, there are two options: 'TEXT SMS Spam Classification' and 'IMAGE CIFAR-10'. Below these options is a 'Select' button, which is circled in red. A note at the bottom states: '□ Your training data will be used by IBM for research, testing, and offering development related to Watson OpenScale. If you do not want IBM to use your training data, check the box, and IBM will not use the training data associated with this submission.'

5. Click on the new connection tab.
6. Under Cloud Object Storage instance select your cloud storage from the dropdown.
7. Under Bucket Containing results data enter “neunets-XXXX-results” where the Xs are your initials in lowercase (e.g. neuneuts-mpc-results).
8. Click Create.

Existing connections [New connection](#)

**Connection name**  
New COS connection - 7 Mar 2019  
Connection name is restricted to upper and lowercase letters, numbers, underscores, dashes, periods and spaces. Once created, the new connection will be visible as a data asset in your project.

Restrict connection access to selected bucket  
⚠️ Unrestricted connections have access to buckets beyond the selected bucket. Be careful not to delete any buckets that may be used for project or catalog storage.

**Cloud Object Storage instance**  
[cloud-object-storage-as](#)

**Bucket containing results data**  
 Existing  New  
[neunets-mpc-results](#)  
Bucket name is restricted to lowercase letters from a to z, numbers, or dashes, between 3 and 64 characters in length.

[Cancel](#) [Create](#)

9. Back on the Synthesize text or image classifier page, enter a name and description.

10. Select your Machine Learning service under Machine Learning Service Instance.

Define classifier details

Name  CIFAR\_10\_Model

Description  CIFAR NeuNet

Project

Add synthesized text or image classifier to an existing project.

Machine Learning Service Instance  pm-20-ez

Data type i

Image  Text  From sample i

**TEXT**  
SMS Spam Classification  
The Text SMS Spam Classification data set includes SMS messages that are classified as spam or legitimate messages.

**IMAGE**  
CIFAR-10  
CIFAR-10 is a labeled subset of the 80 million tiny images dataset, referenced in the technical report "Learning Multiple Layers of Features from Tiny Images", Alex Krizhevsky, 2009

Trained model connection i

Results: New COS connection - 7 ... / neunets-mpc-results Update

Your training data will be used by IBM for research, testing, and offering development related to Watson OpenScale. If you do not want IBM to use your training data, check the box, and IBM will not use the training data associated with this submission.

Cancel Begin Synthesis

11. Select from Sample along the right side and click CIFAR 10.

12. Click Begin Synthesis.

Synthesize text or image classifier BETA

Define classifier details

Name

Description

Project

Add synthesized text or image classifier to an existing project.

Machine Learning Service Instance

Data type i

Image  Text  From sample i

**TEXT**  
SMS Spam Classification  
The Text SMS Spam Classification data set includes SMS messages that are classified as spam or legitimate messages.

**IMAGE**  
CIFAR-10  
CIFAR-10 is a labeled subset of the 80 million tiny images dataset, referenced in the technical report "Learning Multiple Layers of Features from Tiny Images", Alex Krizhevsky, 2009

Trained model connection i

Results: New COS connection - 7 ... / neunets-mpc-results Update

Your training data will be used by IBM for research, testing, and offering development related to Watson OpenScale. If you do not want IBM to use your training data, check the box, and IBM will not use the training data associated with this submission.

Cancel Begin Synthesis Begin Synthesis

### 13. Click Create.

Location to store trained model

Existing connections      New connection New connection

Connection name  
New COS connection - 7 Mar 2019

Connection name is restricted to upper and lowercase letters, numbers, underscores, dashes, periods and spaces. Once created, the new connection will be visible as a data asset in your project.

Restrict connection access to selected bucket  
⚠ Unrestricted connections have access to buckets beyond the selected bucket. Be careful not to delete any buckets that may be used for project or catalog storage.

Cloud Object Storage instance  
cloud-object-storage-as

Bucket containing results data  
 Existing     New

NeuNets\_JDII\_Results

Bucket name is restricted to lowercase letters from a to z, numbers, or dashes, between 3 and 64 characters in length.

Cancel Create

Your model may take a long time to synthesize.

### 14. Click on Confusion matrix and observe further results.

IBM Watson Studio      Upgrade      John Doe's Account

My Projects / Trusted AI Project / CIFAR\_10\_Model

CIFAR\_10\_Model X

Associated Service : pm-20-ez

Job accepted      Preprocessing      Synthesizing      Completed

Download model      Deploy model to Watson Machine Learning

**Status**  
Synthesizing complete. You can download or deploy your model.

**Performance**  
Accuracy 90.8%      Precision 0.907      Recall 0.908

**Training data**

Content type	image
Source bucket	synthesized-neural-network-sample-cifar10
Number of classes	10

**Label statistics**      Confusion matrix

Total training samples 48000      Total classes 10

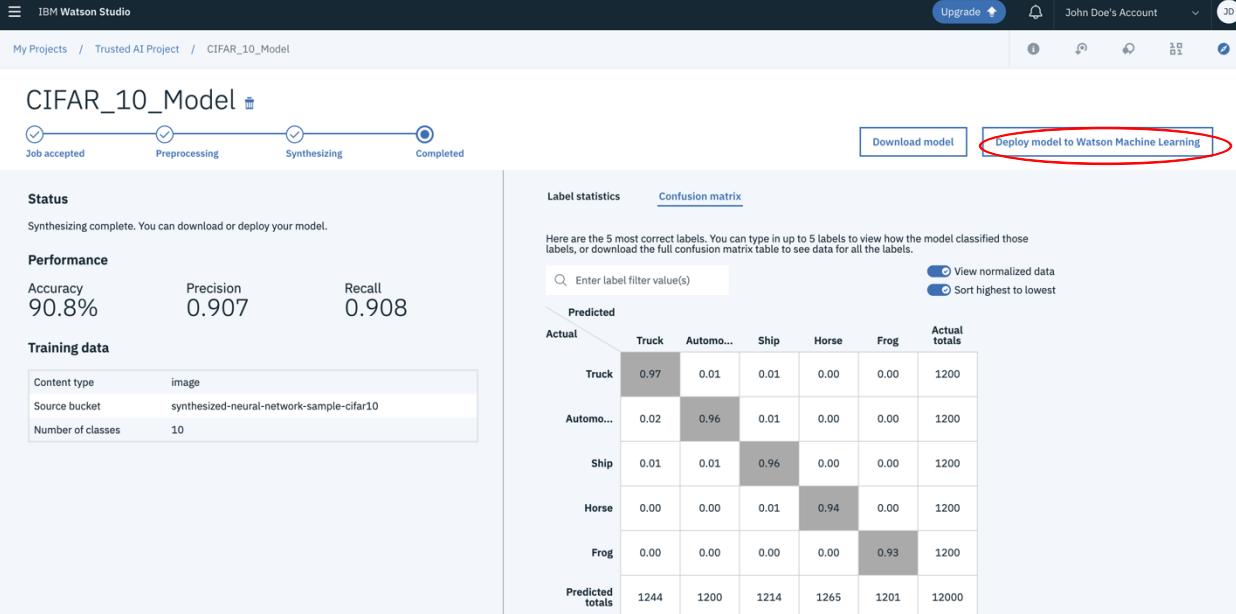
Enter label filter value(s)       View validation samples       Sort highest to lowest

Lowest training samples per class

	1000	2000	3000	4000	5000
Aeroplane	4800	4800	4800	4800	4800
Automobile	4800	4800	4800	4800	4800
Birds	4800	4800	4800	4800	4800
Cats	4800	4800	4800	4800	4800
Deer	4800	4800	4800	4800	4800

Showing 5 of 10 total classes  
Show full training data ↗ Download all ↘

## 15. Click on Deploy model to Watson Machine Learning



The screenshot shows the IBM Watson Studio interface for a project named 'CIFAR\_10\_Model'. The top navigation bar includes 'IBM Watson Studio', 'Upgrade', 'John Doe's Account', and various icons. Below the navigation is a breadcrumb trail: 'My Projects / Trusted AI Project / CIFAR\_10\_Model'. A progress bar at the top indicates four steps: 'Job accepted' (green), 'Preprocessing' (green), 'Synthesizing' (green), and 'Completed' (blue). On the right side, there are two buttons: 'Download model' and 'Deploy model to Watson Machine Learning', with the latter being circled in red.

**Status**  
Synthesizing complete. You can download or deploy your model.

**Performance**  
Accuracy 90.8%   Precision 0.907   Recall 0.908

**Training data**  
Content type: image  
Source bucket: synthesized-neural-network-sample-cifar10  
Number of classes: 10

**Label statistics**   Confusion matrix  
Here are the 5 most correct labels. You can type in up to 5 labels to view how the model classified those labels, or download the full confusion matrix table to see data for all the labels.  
Enter label filter value(s)  
 View normalized data  
 Sort highest to lowest

Actual	Truck	Automo...	Ship	Horse	Frog	Actual totals
Truck	0.97	0.01	0.01	0.00	0.00	1200
Automo...	0.02	0.96	0.01	0.00	0.00	1200
Ship	0.01	0.01	0.96	0.00	0.00	1200
Horse	0.00	0.00	0.01	0.94	0.00	1200
Frog	0.00	0.00	0.00	0.00	0.93	1200
Predicted totals	1244	1200	1214	1265	1201	12000

This is now a Watson Machine Learning Model and can be deployed and monitored using all the techniques shown during the first session today as well as the Watson OpenScale session.

You completed the optional lab.