



Real-Time Predictive Analytics Scoring in Bluemix

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1 Document Purpose

This document will outline how to configure and run the SPSS real-time scoring sample in Bluemix named Sample 1;

<https://github.com/pmservice/predictive-modeling-samples>

- This document is meant to compliment the current documentation associated with Sample 1.
- This document interfaces with an IBM SPSS Modeler stream but the focus is on Bluemix. It is assumed that the reader has a basic understanding of predictive analytics used in IBM SPSS Modeler.
- While there are many supported runtimes in Bluemix (Liberty for Java, Python, Ruby, ASP.NET, Swift, Tomcat, etc.), this document will use SDK for Node.js.
- Other operating systems are supported but this example uses MS Windows.

2 Prerequisites

2.1 Bluemix

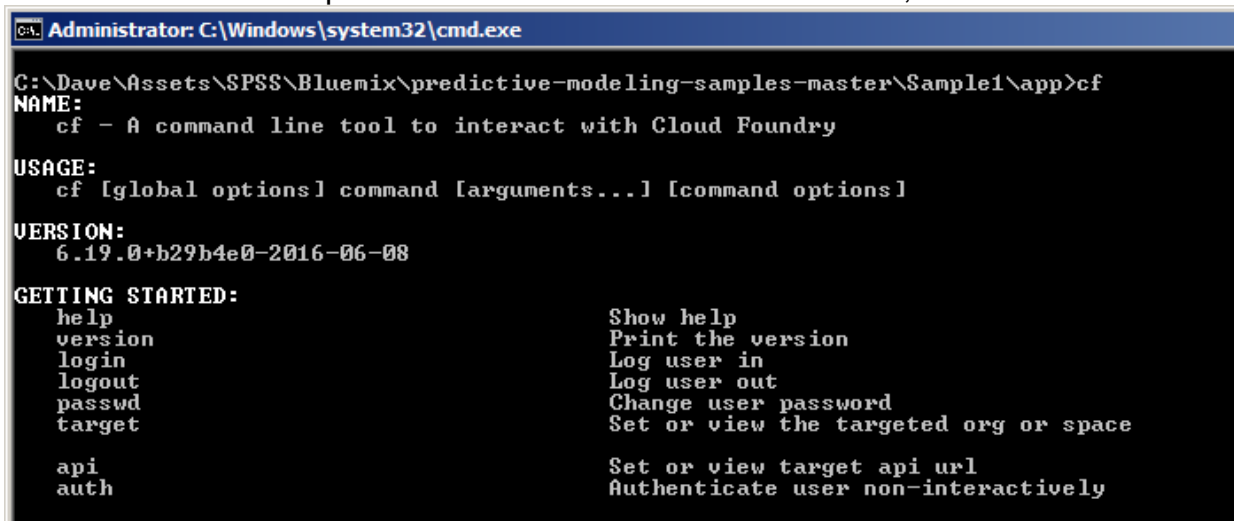
1. Ensure that you have a valid [Bluemix](#) account.

2.2 Cloud Foundry

2. Install the Cloud Foundry (CF) Command Line Interface;
<https://github.com/cloudfoundry/cli/releases>
3. Ensure that the tool is running properly by typing the following from a command prompt;

cf

You should receive output that looks similar to the screen below;



```
Administrator: C:\Windows\system32\cmd.exe
G:\Dave\Assets\SPSS\Bluemix\predictive-modeling-samples-master\Sample1\app>cf
NAME:
  cf - A command line tool to interact with Cloud Foundry

USAGE:
  cf [global options] command [arguments...] [command options]

VERSION:
  6.19.0+b29b4e0-2016-06-08

GETTING STARTED:
  help                Show help
  version             Print the version
  login              Log user in
  logout            Log user out
  passwd            Change user password
  target            Set or view the targeted org or space

  api              Set or view target api url
  auth             Authenticate user non-interactively
```

Note: you may have to reboot your system in order for it to locate the “cf” executable. Do not proceed if the “cf” command does not run.

2.3 Node.js

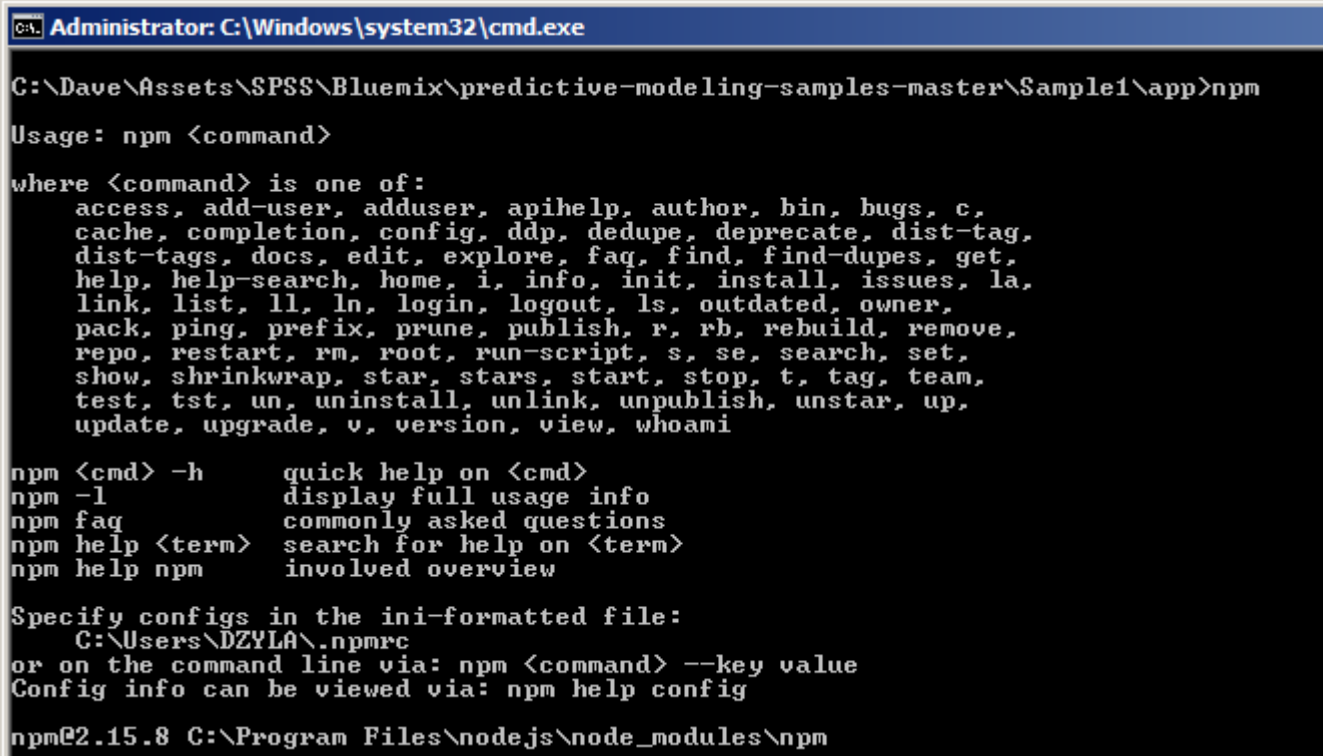
Node.js is required to download supporting code from Bluemix to the local development environment. Additional information can be found at;

<https://nodejs.org/en/about/>

1. Download and install Node.js from;
<https://nodejs.org/en/download/>
2. Validate that Node.js is running properly by typing the following from a command prompt;

npm

You should receive output that looks similar to the screen below;



```
Administrator: C:\Windows\system32\cmd.exe
C:\>C:\Dave\Assets\SPSS\Bluemix\predictive-modeling-samples-master\Sample1\app>npm
Usage: npm <command>

where <command> is one of:
  access, add-user, adduser, apihelp, author, bin, bugs, c,
  cache, completion, config, ddp, dedupe, deprecate, dist-tag,
  dist-tags, docs, edit, explore, faq, find, find-dupes, get,
  help, help-search, home, i, info, init, install, issues, la,
  link, list, ll, ln, login, logout, ls, outdated, owner,
  pack, ping, prefix, prune, publish, r, rb, rebuild, remove,
  repo, restart, rm, root, run-script, s, se, search, set,
  show, shrinkwrap, star, stars, start, stop, t, tag, team,
  test, tst, un, uninstall, unlink, unpublish, unstar, up,
  update, upgrade, v, version, view, whoami

npm <cmd> -h      quick help on <cmd>
npm -l           display full usage info
npm faq          commonly asked questions
npm help <term>  search for help on <term>
npm help npm     involved overview

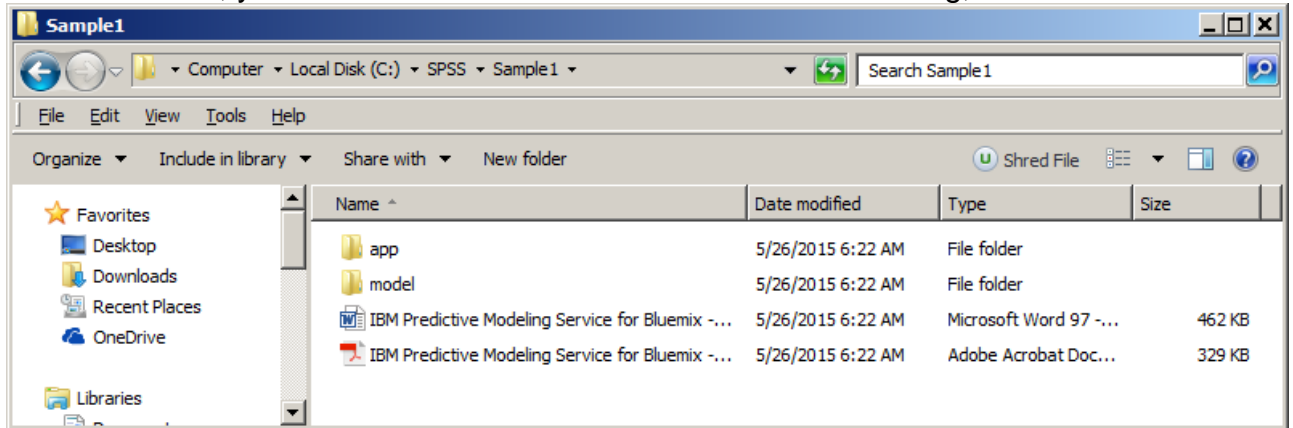
Specify configs in the ini-formatted file:
  C:\Users\DZYL\A\npmrc
or on the command line via: npm <command> --key value
Config info can be viewed via: npm help config

npm@2.15.8 C:\Program Files\nodejs\node_modules\npm
```

Note: you may have to reboot your system in order for it to locate the “npm” executable. Do not proceed if the “npm” command does not run.

2.4 Download Sample 1

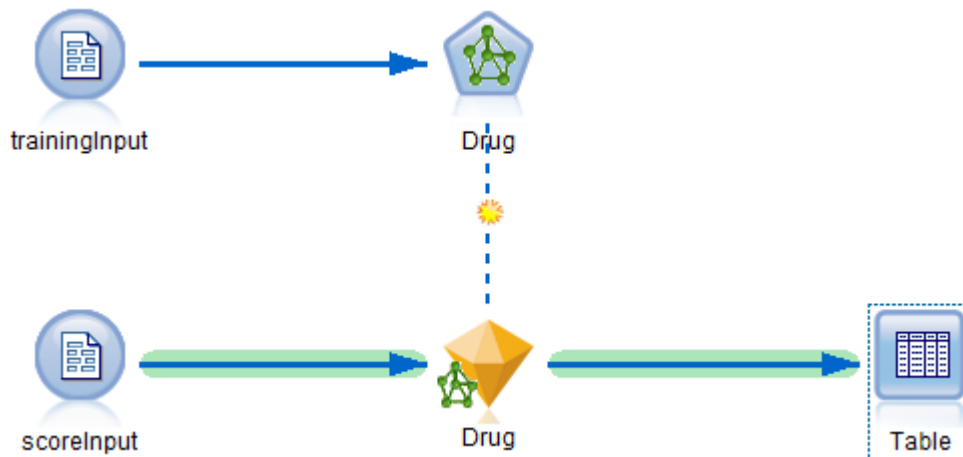
1. Download Sample 1 from;
<https://github.com/pmservice/predictive-modeling-samples>
2. Extract the contents to a working directory. This example will use;
C:\SPSS
3. Once extracted, you should have a folder structure like the following;



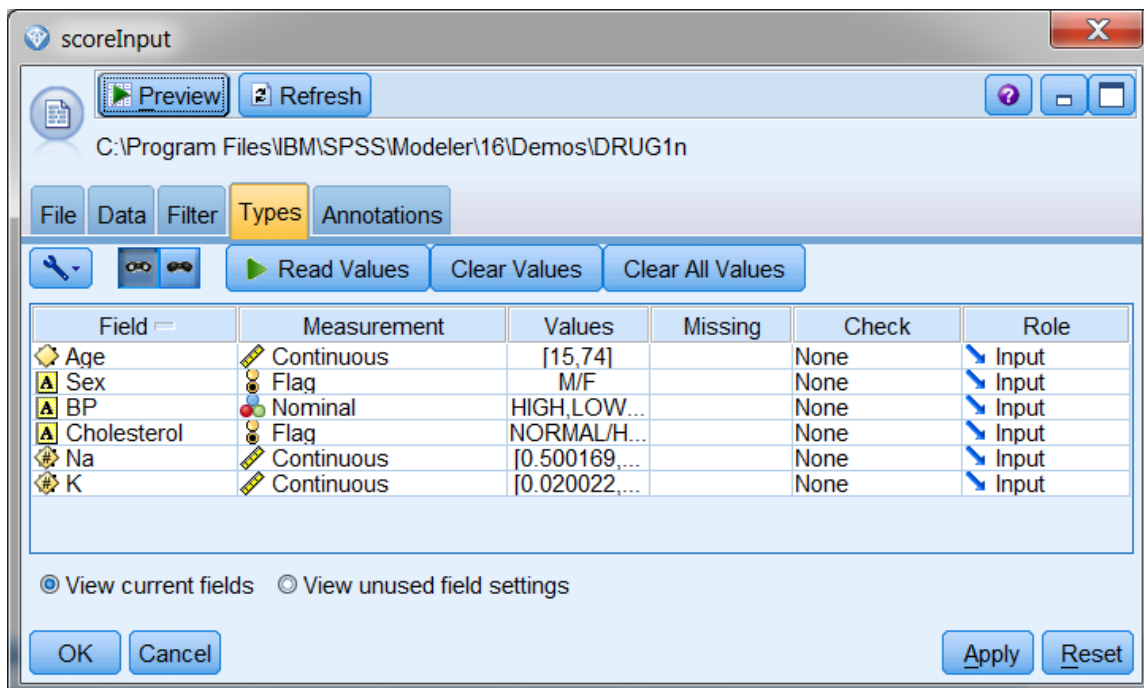
3 IBM SPSS Modeler

The sample comes with an SPSS Modeler stream which can be found at;
C:\SPSS\Sample1\model\Drug1n.str

It is important to note that a scoring branch has been set in the stream. Any model used in the Bluemix Predictive Analytics node must have a scoring branch set. This can simply be done by right clicking the terminal node and selecting “Use as scoring branch”.



The Bluemix application will have to provide the same data items used in the input node. In this case it is the “scoreInput” node.



Bluemix will return scored results in the \$N-Drug (prediction) and \$NC-Drug (prediction confidence) columns.

Field	Format	Justify	Column Width
Age	####	Auto	Auto
Sex		Auto	Auto
BP		Auto	Auto
Cholesterol		Auto	Auto
Na	####.###	Auto	Auto
K	####.###	Auto	Auto
\$N-Drug		Auto	Auto
\$NC-Drug	####.###	Auto	Auto

☒ View current fields ☐ View unused field settings

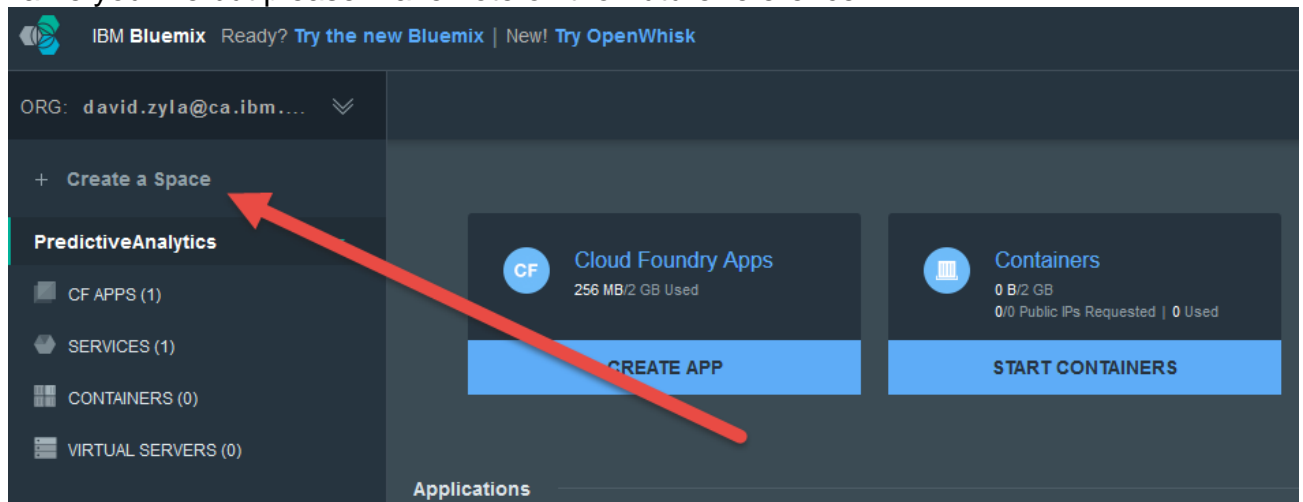
OK Run Cancel Apply Reset

Unlike an on-premises solution, real-time scoring in Bluemix cannot integrate with Analytical Decision Management or Collaboration and Deployment Services.

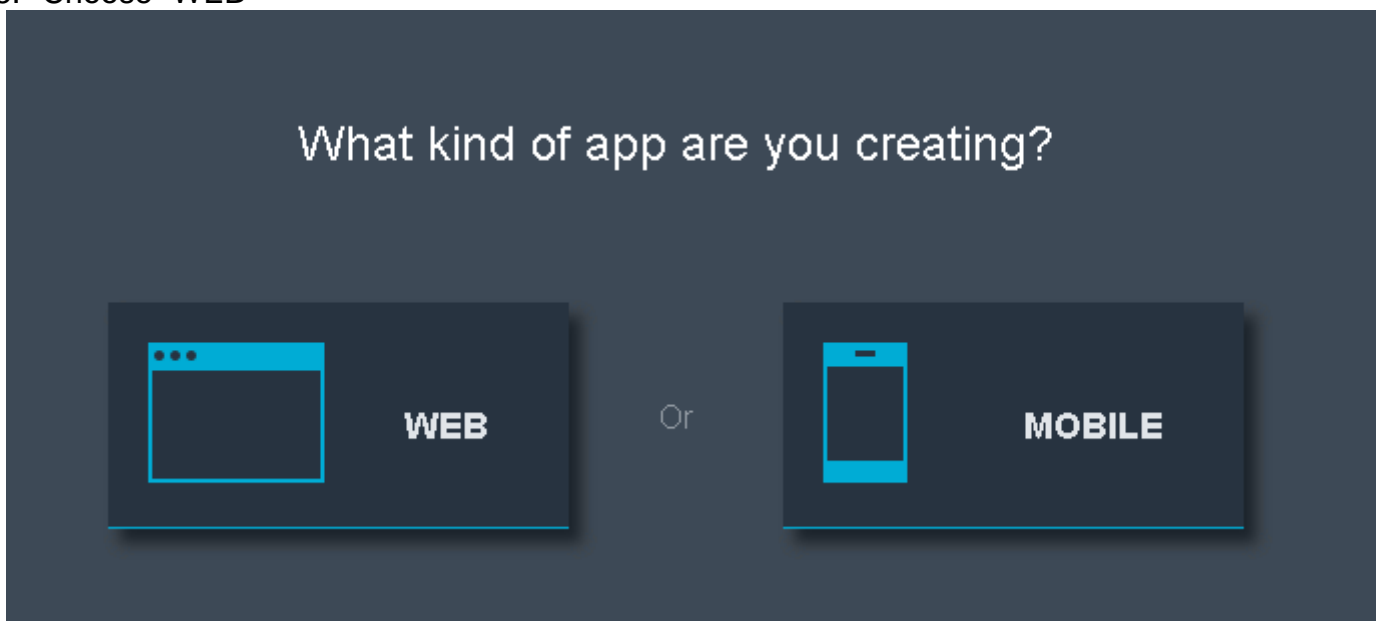
4 Bluemix Application and Service

4.1 Application Creation

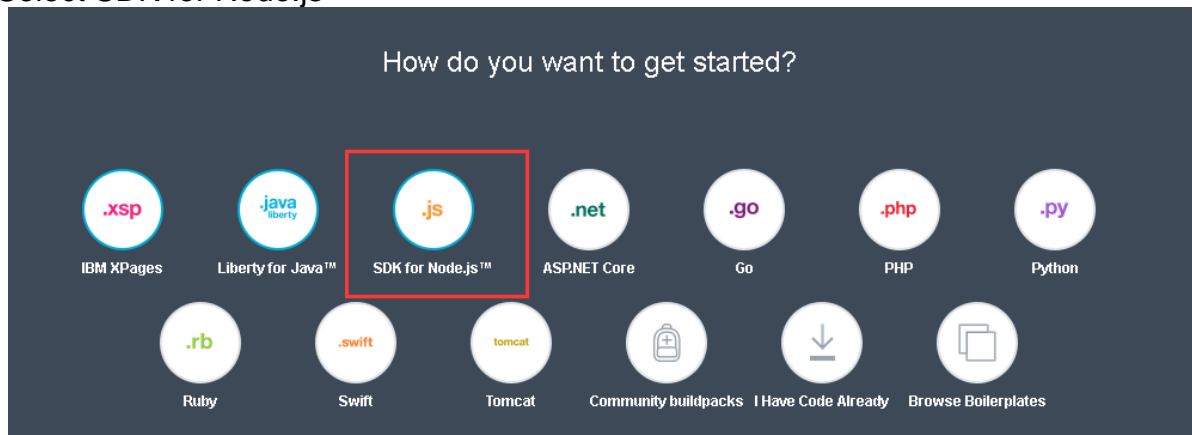
1. Login to Bluemix.
2. If you don't already have a Space created, create one now. The space can be whatever name you like but please make note of it for future reference.



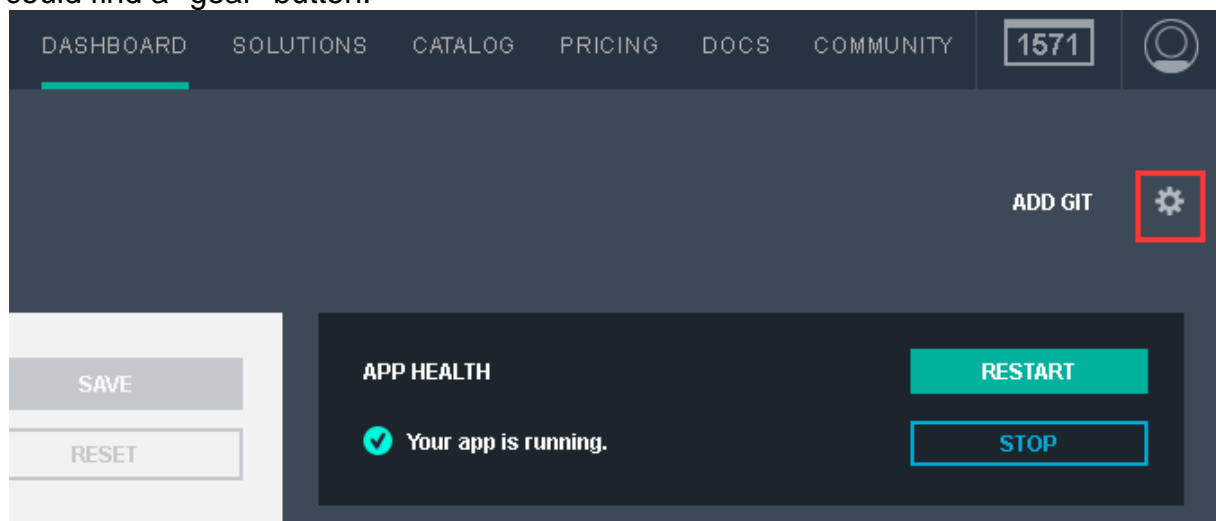
3. Once you have created the new space, click on it on the left hand side of your screen.
4. On the top of the page click on "Create app"
5. Choose "WEB"



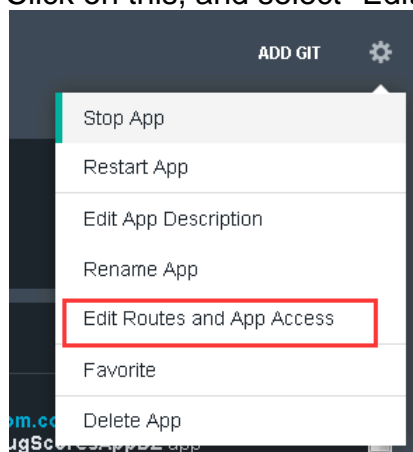
6. Select SDK for Node.js



7. Name the new application. Note that this name can be whatever you want. This example will use "SPSSDrugScoresAppDZ". (Or any other name you like, but it can't be too long)
8. Click Create. This will stage and create the application. This process may take a minute or two to complete.
9. After the application is created, go back to the dashboard, you could see the application "SPSSDrugScoresAppDZ".
10. Click on the application, and go to the application overview page. On the top right corner, you could find a "gear" button.



11. Click on this, and select "Edit Routes and App Access"



12. In the second selection box, it's this app's domain name.

×

Edit Routes and App Access


spssdrugscoresappdz

stage1.eu-gb.mybluemix.net

[Add route](#)

Enable app authentication
Restrict app access to members of this organization

OFF

[Manage Domains](#) 

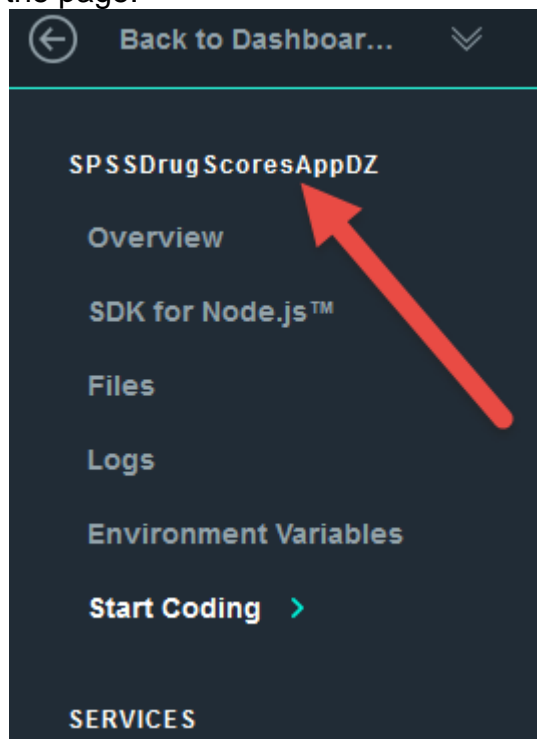
SAVE

CANCEL

13. Make note of the Space, App Name, Host and Domain as they will be referred to later on.

4.2 Service Creation

1. Ensure that the SDK for Node.js application is running and is selected on the left hand side of the page.



2. Click on Catalog from the upper toolbar.
3. To filter the number of services displayed, select "Data and Analytics" under Services on the left hand side of the screen.
4. Click on Predictive Analytics.

5. On the Add Service screen, ensure that the App drop down is changed from Leave Unbound to the application that you created previously. This will bind the service to the application.

IBM Predictive Analytics is a full-service Bluemix offering that makes it easy for developers and data scientists to work together to integrate predictive capabilities with their applications. Built on IBM's proven SPSS analytics platform, Predictive Analytics allows you to develop applications that make smarter decisions, solve tough problems, and improve user outcomes.

Pick a plan Monthly prices shown are for country or region: [Canada](#)

Plan	Features	
✓ Free Plan	1 Service Instance (2 models maximum) 5,000 Real-time or batch predictions 5 Compute-hours for analysis and model building	Free
<p>Info: The free plan provides you with a single instance of the Predictive Analytics service with a maximum of 2 models, 5,000 predictions per month, and 5 hours of compute time for analysis and model building operations.</p>		
Paid Plan	Service instance (20 models per instance) Real-time predictions Batch predictions Analysis and model building compute-hour	\$10.57 CAD/Instance \$0.53 CAD/1,000 Real-time predictions \$0.53 CAD/1,000 Batch predictions \$0.48 CAD/Compute-hour

[VIEW DOCS](#)

[TERMS](#)

Add Service

Space: SPSS_RT_Scoring

App: SPSSDrugScoresAppDZ SPSSDrugScoresAppDZ...

Service name: Predictive Analytics-49

Selected Plan: Free Plan

CREATE

6. Make note of the App and Service names.
7. Click Create. If prompted to re-stage, select yes.
8. Navigate back to the top Dashboard page to display both the application and service.

ORG: david.zyla@ca.ibm....

+ Create a Space

PredictiveAnalytics

SPSS_RT_Scoring

CF APPS (1)

SERVICES (1)

CONTAINERS (0)

VIRTUAL SERVERS (0)

CREATE APP

Applications

SPSSDrugScoresAppDZ
SPSSDrugScoresAppDZ.mybluemix.net

Running

Services

Predictive Analytics-49
Predictive Analytics

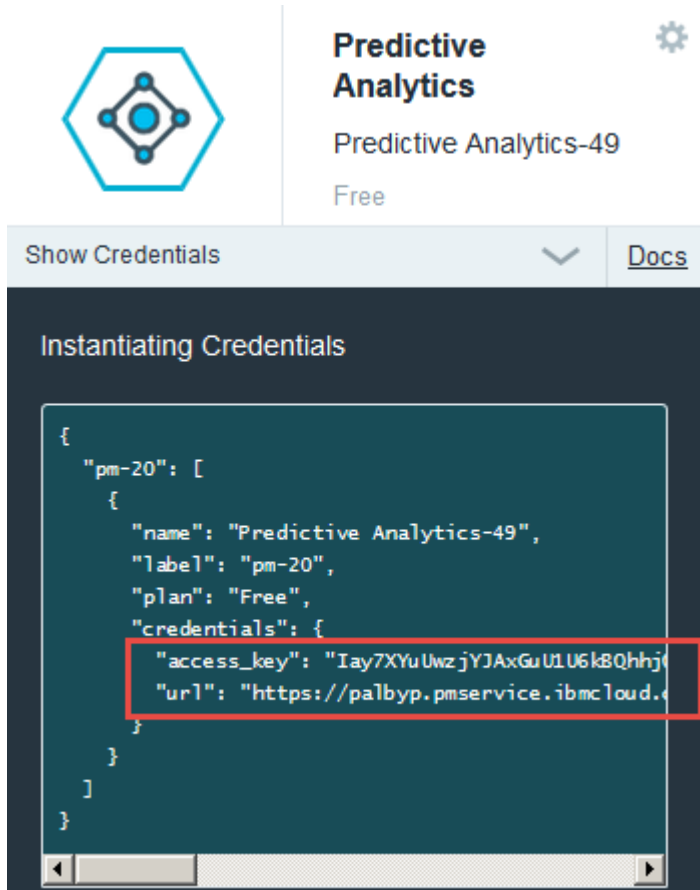
Plan: Free

9. Click on the application (SPSSDrugScoresAppDZ).

10. When we score the input data in this example, credentials have to be supplied to Bluemix at runtime. Click on the up arrow to show the credentials.



In the fly-out window, make note of the the access key and URL, these will needed later on.



"access_key":

"Iay7XYuUwzjYJAXGuU1U6kBQhhjQLydoIFxLveWn3XUy98gODPY6vx3TabOtWZqeHxGxQ3plogjgEOjN0TGDTcL0h32gVzPkwMbmHXNpi+EHoRceM3jXlle+y3OFM4+zBk8Cu9s4bKs2CqegHQphv+eqc4NgPgKMPJdgqshDkv4="

"url": "https://palbyp.pmservice.ibmcloud.com/pm/v1"

11. At this point in time the application and service containers are ready.

5 File Customization

This section deals with customizing the files that were downloaded to the SPSS Working directory; C:\SPSS\Sample1

5.1 \app\manifest.yml

Manifest.yml contains information about the deployment and is typically used to reduce the number of deployment details that you must specify every time that you deploy an application to Bluemix.

1. Open the following file in a text editor;
C:\SPSS\Sample1\app\manifest.yml
2. Change the value of the **host** variable to reflect what was used in the Application Creation section above. In this example, SPSSDrugScoresAppDZ was used
3. Change the value of the **name** variable to reflect what was used in the Application Creation section above. In this example, SPSSDrugScoresAppDZ was used
4. Change the value of the **domain** variable to reflect what was used in the Application Creation section above. In this example, mybluemix.net was used
5. Change the value of the **memory** variable to 256M.
6. Add the following line;
disk_quota: 1024M
7. Save and close the file.

5.2 \app\app.js

1. Open the following file in a text editor;
C:\SPSS\Sample1\app\app.js
2. Navigate to line 21 and update the defaultBaseURL that was recorded in the Service Creation section above. Note that the <> must be removed and the entire string value be encapsulated in single quotes '.

```
var defaultBaseURL = 'https://palbyp.pmservice.ibmcloud.com/pm/v1';
```

3. Similarly to the step above, update the defaultAccessKey value key on line 22.
4. Save and close the file.

5.3 \app\public\js\app.js

1. Open the following file in a text editor;
C:\SPSS\Sample1\app\public\js\app.js
2. Navigate to line 8.
3. Note that the value of the \$scope.context variable is drug1N. While no change is required in this file, these steps are here to outline that every SPSS model scored in Bluemix must have a unique context ID. This will be discussed further in the Uploading SPSS Models section.
4. Close the file, no change is required.

5.4 \app\public\js\srv.js

1. Open the following file in a text editor;
C:\SPSS\Sample1\app\public\js\srv.js
2. Navigate to line 10. Note that the tablename variable matches the name of the source node in the SPSS Modeler model.



scoreInput

3. Examine lines 11 and 12. Note that these inputs match the input columns in the scoreInput node.

The screenshot shows the 'scoreInput' node configuration dialog in SPSS Modeler. The dialog has a title bar with the node name and a close button. Below the title bar are buttons for 'Preview' and 'Refresh'. The path 'C:\Program Files\IBM\SPSS\Modeler\16\Demos\DRUG1n' is displayed. There are tabs for 'File', 'Data', 'Filter', 'Types', and 'Annotations', with 'Data' being the active tab. A table lists input fields with their storage and input format settings.

Field	Override	Storage	Input Format
Age	<input type="checkbox"/>	Integer	
Sex	<input type="checkbox"/>	String	
BP	<input type="checkbox"/>	String	
Cholesterol	<input type="checkbox"/>	String	
Na	<input type="checkbox"/>	Real	
K	<input type="checkbox"/>	Real	
Drug	<input type="checkbox"/>	String	

Below the table are two radio buttons: 'View current fields' (selected) and 'View unused field settings'. At the bottom are buttons for 'OK', 'Cancel', 'Apply', and 'Reset'.

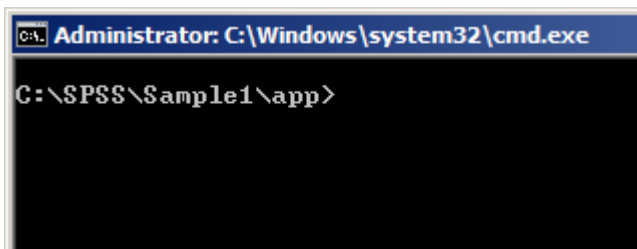
4. If you were to use a stream that used a different source node and had other parameters, they would have to be updated here.
5. Close the file, no change is required.

6 Porting Source Code

6.1 Node Package Manager

The Node Package Manager utility is used to download supplemental files from Bluemix. The Start Coding section of the Bluemix application has some of the commands that will help you with connecting to your Bluemix environment. It may be easier to use the commands there than to customize the steps below.

1. Launch a command prompt.
2. Change directory to;
C:\SPSS\Sample1\app



3. Connect to IBM® Bluemix® by typing the following command into the command prompt window.
bluemix api <https://api.ng.bluemix.net>
4. Login to Bluemix by typing the command below into the command prompt window.
bluemix login -u david.zyla@ca.ibm.com -o david.zyla@ca.ibm.com -s SPSS_RT_Scoring
5. Type your password when prompted.

- Download the supplemental files by typing;
npm install

This will create the following directory;
C:\SPSS\Sample1\app\node_modules

```
Administrator: C:\Windows\system32\cmd.exe

C:\SPSS\Sample1\app>npm install
npm WARN package.json SPSS-PM-sample-1@0.1.0 No README data
npm WARN package.json SPSS-PM-sample-1@0.1.0 No license field.
body-parser@1.0.2 node_modules\body-parser
├── qs@0.6.6
├── raw-body@1.1.7 <string_decoder@0.10.31, bytes@1.0.0>
└── type-is@1.1.0 <mime@1.2.11>

express@4.0.0 node_modules\express
├── methods@0.1.0
├── parseurl@1.0.1
├── debug@0.8.1
├── qs@0.6.6
├── utils-merge@1.0.0
├── escape-html@1.0.1
├── cookie-signature@1.0.3
├── range-parser@1.0.0
├── fresh@0.2.2
├── buffer-crc32@0.2.1
├── path-to-regexp@0.1.2
├── merge-descriptors@0.0.2
├── cookie@0.1.0
├── type-is@1.0.0 <mime@1.2.11>
├── send@0.2.0 <mime@1.2.11>
├── accepts@1.0.0 <mime@1.2.11, negotiator@0.3.0>
└── serve-static@1.0.1 <send@0.1.4>

request@2.36.0 node_modules\request
├── aws-sign2@0.5.0
├── forever-agent@0.5.2
├── tunnel-agent@0.4.3
├── qs@0.6.6
├── oauth-sign@0.3.0
├── mime@1.2.11
├── json-stringify-safe@5.0.1
├── tough-cookie@2.2.2
├── node-uuid@1.4.7
├── http-signature@0.10.1 <assert-plus@0.1.5, ctype@0.5.3, asn1@0.1.11>
├── form-data@0.1.4 <async@0.9.2, combined-stream@0.0.7>
└── hawk@1.0.0 <cryptiles@0.2.2, boom@0.4.2, sntp@0.2.4, hoek@0.9.1>
```

- To push all files along with the customizations that were made, run the following command;
cf push <Application Name>
cf push SPSSDrugScoresAppDZ
- The application has now been uploaded to Bluemix.

7 Uploading SPSS Models

At this point in time we have moved our custom application to IBM Bluemix but we still need to provide Bluemix with the SPSS models that we want to use.

1. Launch a browser and login to Bluemix.
2. From the Dashboard, click on the predictive analytics service that was created previously.
3. In the bottom right hand corner note that there is a New Model Stream section. The SPSS model that we are going to provide can be found in;
C:\SPSS\Sample1\model\Drug1n.str

Upload the model by either dragging and dropping it or by using the Select File option.

4. You will be prompted to provide a Context Id. While this ID can be anything, for this example it must be drug1N.

The screenshot shows the IBM Predictive Analytics dashboard. The top section is a blue header with 'Welcome' and 'About' tabs. Below this is a 'Deployed Model Usage' section with a donut chart and a 'No Models, Yet' message. To the right is a 'New Model Stream' section with a dashed box for dropping a file and a 'Select File' button. A 'Deploy Predictive Model' dialog box is open in the foreground, prompting for a 'Context Id' (with 'drug1N' entered) and a 'File to be used for model deploy' (with 'Drug1n.str' entered). The dialog has 'Cancel' and 'Deploy' buttons.

Predictive Analytics

Welcome

About Samples

Predictive Analytics provides a set of REST APIs for integrating predictive capabilities with your Bluemix or standalone applications.

To Get Started:

- Create your data model using [IBM SPSS Modeler \(Free Trial\)](#)
- Upload your model to the Predictive Analytics service
- Call the scoring API from your app

Resources:

- [Full API Documentation](#)

Deployed Model Usage

No Models, Yet

Export your SPSS models, then drag and drop them to the box on the right

New Model Stream

Drop SPSS model file to deploy

or [Select File](#) to upload

Deploy Predictive Model

Add a model stream containing a scoring branch for deployment to Bluemix.

Context Id *

drug1N

File to be used for model deploy


Drug1n.str

Cancel Deploy

5. If you choose a different Context Id you must make the respective change in C:\SPSS\Sample1\app\public\js\app.js

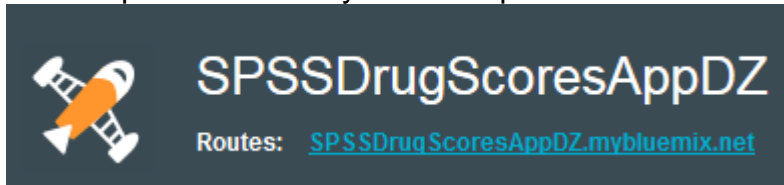
which was discussed earlier. Enter “drug1N” now.

6. Click Deploy.
7. The model will be listed in the bottom section of the screen.


Manage Models - Status: Active				
Context Id	File	Date Created	Date Updated	Action
drug1N	Drug1n.str	7/8/16	7/8/16	

8 Real-Time Scoring the Sample

1. Within Bluemix, navigate to your Dashboard.
2. Click on the application that you created.
3. At the top of the screen you will be presented with the URL to access your application.




4. Click on the URL.
5. You will now be presented with your real-time scoring application.

 IBM SPSS Predictive Modeling service "Drug 1N" scoring applicaiton

The image shows the real-time scoring application interface. It has a light blue background. At the top, there is a text input field for 'Age' with the value '35'. Below it is a radio button selection for 'Sex' with 'Male' selected. Further down is a section titled 'Blood Test Results:' containing three radio button selections: 'Blood Pressure' with 'NORMAL' selected, 'LDL (bad) Cholesterol' with 'NORMAL' selected, 'Sodium Level' with the value '0.697', and 'Potassium Level' with the value '0.056'. At the bottom of the form is a button labeled 'Score Now' with an upward-pointing arrow icon.

6. You can change any of the values to simulate data being entered by a user of this application.
7. Click the Score Now button

 Score Results

Age	Sex	BP	Cholesterol	Na	K	\$N-Drug	\$NC-Drug
35	M	NORMAL	NORMAL	0.697	0.056	drugX	0.9999482075987031

 Close

8. In this example the input along with the predicted drug and predicted confidence are being displayed to the screen.

You can see now that this exercise has walked through the process of;

- Setting up the necessary development tools
- Customizing the sample code
- Uploading an SPSS model
- Scoring the SPSS model with data provided in real-time