IBM Predictive Customer Intelligence
Version 1.x

# Personalized Promotions for Retail Customers 1.0

IBM

## Product Information

This document applies to IBM Predictive Customer Intelligence Version 1.0.1 and may also apply to subsequent releases.

# Contents

# Introduction

IBM® Predictive Customer Intelligence gives you the information and insight that you need to provide proactive service to your customers. The information can help you to develop a consistent customer contact strategy and improve your relationship with your customers.

IBM Predictive Customer Intelligence brings together, in a single solution, the ability to do the following tasks:

- Determine the best offer for a customer.
- Retain customers that are likely to churn.
- Segment your customers, for example, by family status and salary.
- Identify the most appropriate channel to deliver an offer, for example, by email, telephone call, or application.

This solution ensures that all interactions with customers are coordinated and optimized. IBM Predictive Customer Intelligence gives you the ability to sift quickly through millions of customers and know who to contact, when, and with what action.

The following steps define the process:

1. Understand the customer. Predictive modeling helps you to understand what market segments each customer falls into, what products they are interested in, and what offers they are most likely to respond to.
2. Define possible actions and the rules and models that determine which customers are eligible for which offers.
3. After the best action is identified, deliver the recommendation to the customer.

## Audience

This guide is intended to provide users with an understanding of how the IBM Predictive Customer Intelligence solution works. It is designed to help people who are planning to implement IBM Predictive Customer Intelligence know what tasks are involved.

## Finding information

To find product documentation on the web, including all translated documentation, access IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSCJHT_1.1.0).

PDF versions of the documents are available from the Predictive Customer Intelligence version 1.1 product documentation page (www.ibm.com/support/docview.wss?uid=swg27046802).

## Accessibility features

Accessibility features help users who have a physical disability, such as restricted mobility or limited vision, to use information technology products. Some of the components included in the IBM Predictive Customer Intelligence have accessibility features.

**v**

IBM Predictive Customer Intelligence HTML documentation has accessibility features. PDF documents are supplemental and, as such, include no added accessibility features.

## Forward-looking statements

This documentation describes the current functionality of the product. References to items that are not currently available may be included. No implication of any future availability should be inferred. Any such references are not a commitment, promise, or legal obligation to deliver any material, code, or functionality. The development, release, and timing of features or functionality remain at the sole discretion of IBM.

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# Chapter 1. Personalized Promotions for Retail Customers

Personalized Promotions for Retail Customers shows how IBM Predictive Customer Intelligence can be used in the retail industry to achieve specific results.

**Understand the customer**
> Profile customers based on browsing and purchase history.
>
> Track propensity to respond to different types of offers.
>
> Identify the behaviors that convert browsers to shoppers.

**Find the right offer**
> Increase profits with targeted offers informed by market basket analysis.
>
> Combine the customer profile and history to identify the next likely purchase.
>
> Prioritize offers based on expected profit.

**Find the right channel**
> Tailor offers to the point of interaction.
>
> Build cross-channel loyalty with coupons informed by online activity for use in the physical store.

## Predictive retail promotions process

Use IBM Predictive Customer Intelligence predictive modeling to understand what market segments each customer falls into, what products they are interested in, and what offers they are most likely to respond to.

Then, you can identify the stage of the online purchase funnel that the customer is in:

- visitor
- product viewer
- buyer
- repeat buyer

You can determine how valuable the customer is in terms of revenue, and look at what the demographic profile says about the customer. For example, would they be interested in purchasing Product X, based on past purchase behavior? You can also establish the optimal discount that will entice a customer to purchase the product.

Using IBM SPSS® Modeler, you can build models that predict how a customer is likely to behave.

### Define possible actions

The next step is to define the rules and models that determine which customers are eligible for which offers. The goal is to determine how a customer can be progressed through the online purchase funnel: that is, from a visitor to a product viewer, a product viewer to a buyer, and a buyer to a repeat buyer.

Using IBM Analytical Decision Management, you can combine predictive models with business rules to allocate offers in accordance with business goals.

### Deliver best actions to the point of interaction

When the best action is identified, the recommendation is delivered to the point of interaction. For example, recommendations can be presented to the retail customer who logs in to a retail website.

# Increase revenue through targeted recommendations

Personalized Promotions for Retail Customers shows how IBM Predictive Customer Intelligence can be used to ensure that an online retail electronics customer progresses through the purchase funnel: from visitor to product viewer, from product viewer to buyer, and from buyer to repeat buyer.

### Customer profile

Ross Wilson is a customer who registered for an online retail site recently. Ross has only visited the website a few times and has not spent much time viewing individual products. He has not purchased anything from the website. Ross's lifetime value is Medium, his buying behavior is In-Store Medium Value Offer Seeker, and his demographic cluster is High Income Value. These are predicted values that are derived from data from both the online store and the physical store.

### Stage 1: Visitor

Ross visits the retail website. Based on the demographic profile, visits, and in-store (physical store) purchase details, the Category Affinity model predicts that Ross is most likely to be interested in MP3 players. The website takes Ross to the MP3 player home page. The Inventory-based suggestion model looks at the available stock that is expected to run high on inventory and generates a list of eight MP3 players. The model is based on time series forecasting, current inventory, and the demand variance of all the products. The model also generates a single offer in the MP3 player area for Ross, showing him a clearance item that he currently ignores.

### Stage 2: Product viewer

Ross clicks the **Product Details** link for Surf Force MP3 XR32-Silver. The customer segmentation model changes Ross's classification from Visitor to Product Viewer. As a result, two new offers, which are aimed at progressing Visitors to Product Viewers, are shown to him.

### Stage 3: Buyer

Ross decides to purchase this product and adds it to his cart. When Ross completes his purchase of the MP3 player, he is categorized as a Buyer, and is now eligible for a different offer.

The new offer uses purchase information, rather than the browsing information. A market basket recommendation of Wave TV 33 Color is made, based on the past purchase patterns of different customers.

### Stage 4: Repeat Buyer

Ross selects the offer, adds the Wave TV to the cart, and checks out. This makes Ross a Repeat Buyer.

Ross receives an offer of 10% extra discount, which is targeted at repeat buyers. Ross also receives a recommendation for a Sonic TLR Thunder Receiver. The choice of this item is based on both of the items that Ross purchased, and is just one of many recommendations. The best recommendation is chosen based on prioritization of offers, generated by an optimization equation that is based on price and cost of the product, the probability that the customer will respond, and expected profit.

Before Ross leaves the site, he decides to look at Big Screen TVs. On an impulse, Ross adds a Wavestation 5000 to the cart.

After reconsidering, Ross removes the TV from the cart, and is offered a discount on the same item.

Because Ross is a Repeat Buyer and he abandoned a cart, he is provided a customized discount. This discount is based on the Price Sensitivity model, which is triggered when the cart is abandoned.

The Price Sensitivity model is developed based on the past purchase behavior of customers of various segments. This model uses two variables to identify the best discount for this customer for this product. The model first takes in the buying behavior segment, which for Ross is In-Store Medium Value Offer Seeker and then the category of product for which discount should be given, "Big Screen TV" (the category of the product he abandoned). Based on both of these factors, the price sensitivity model looks up the best discount that is based on previously developed regression-based models. Ross is given a discount of 5% and the new price is $1044.99, compared to the recommended retail price of $1099.

## Define the offers to be presented to retail customers

Monica, the marketing manager, defines the company's marketing strategy. She determines which offers might be presented to customers when they visit the online store, based on their customer profile data. Customer profile data includes demographic information, behavioral data, purchase history, and attributes such as segment membership and category affinity, which are derived from predictive models.

Monica's goal is to increase revenue by increasing the rate at which visitors to an online website become product viewers, and viewers become buyers.

Monica looks at the browsing, carting, and purchase metrics for various products. The metrics are presented by using IBM Cognos® Business Intelligence reports, which you can drill down on to analyze the online activity pattern of any segment and product combinations.

She sees that there is a low conversion of views into purchase across all product categories and demographic clusters, and decides to make the offers more compelling.

She also sees that the activity is high in the MP3 player section, and decides to apply the Market Basket Analysis model. Market basket analysis allows a retailer

to gain insight into the product sales patterns by analyzing the historical sales records and customer's browsing behavior.

## The campaign

In this case study, the example campaign called Predictive Online Promotions is determined by the online purchase funnel that converts Visitors to Product Viewers, Viewers to Buyers, and then Buyers to Repeat Buyers. The online purchase funnel helps you to understand the buying behavior of an average customer so that you can optimize each transaction within a session to move through the funnel.

Using a retail promotions application that is developed in IBM Analytical Decision Management, customers are segmented into categories in real time by a segmentation model. The model predicts whether the customer is a Visitor, Product Viewer, Buyer, or Repeat Buyer, by using data on past activity, and data from the current session. The model is scored in real time as customers move through the store, capturing each new action as input. For example, a customer might progress from Visitor to Viewer to Buyer within a single session, and be presented with appropriate offers at each stage.

A campaign is created in IBM Analytical Decision Management to correspond to each of the four segments defined. Within each campaign, offers are allocated by using segment rules that might also use predictive models. For example, the Clearance item offer is only presented to customers in the Visitor segment with a history of page views for a relevant product line. In this way, a customer's personal preferences can be matched with the items currently on clearance.

Offers can be tailored further by specifying the value of a field or model output to be returned with each offer. For example, for the Clearance offer, the specific product (for example, MP3 Player) that is returned with the offer is selected by the Inventory-Based Suggestion model. This model compares inventory with the customer's known purchase preferences. One model determines which customers are eligible for the offer, and another model determines which product to offer.

# Determine the best offers for retail customers by creating business rules

Alex, a business analyst, uses IBM Analytical Decision Management to bring together the company's business rules and predictive models to determine the best possible offer for a customer.

Alex creates business rules under each campaign to determine which actions are valid for any single customer. Here are some examples of what you might set up rules for in the current example, the Predictive Online Promotions campaign.

**Visitor**
>    Clearance item
>
>    Earn double loyalty points

**Product viewer**
>    Value deal
>
>    Popular products
>
>    1000 loyalty points

**Buyer**   Best in line

   Value deal

**Repeat buyer**
   10% additional when you purchase

   Special discount for you

For example, the Value deal offer is targeted at customers in both the Product Viewer and Buyer segments who are categorized as offer seekers based on previous buying behavior.

A Market Basket Analysis model is used to identify the next likely purchase for the current customer, and returns this item with the offer. For example if the model returns a Gamma Smartphone, the offer presented to the customer would be "Value deal Gamma Smartphone".

For the Repeat Buyer campaign, the offer to be returned is determined by a model that returns a recommendation based on the customer's known sensitivity to price changes.

You can run a simulation for a campaign using sample data to see potential counts of each offer.

Using an optimization equation you can determine the top three offers to be presented to customers based on the following factors:
* Price and cost of the product recommended.
* Probability that the customer will respond.
* Expected profit.

Here is an example of an optimization equation:

```
(PROBABLILITY TO RESPOND * (LIST PRICE - (UNIT COST + OFFER VALUE)))- OFFER
COST
```

For more information, see *IBM Analytical Decision Management Application User's Guide*.

# Build predictive models for retail promotions

David, a data scientist (data engineer), builds predictive models by using IBM SPSS Modeler.

The models are used to gain information for the following purposes:
* Understand the purchase behavior of customers to predict the product lines in which a customer is interested.
* Profile customers based on demographics, online behavior, and buying behavior to help in providing the right offer for the customer at the right time.
* Identify the next product that the customer might be interested in purchasing.
* Determine customer affinity towards product lines by understanding the customer demographic, purchase, and browsing information.
* Find the patterns of customers who are converted to buyers to determine which business rules have the highest impact.

- Determine the extent to which the price of a product affects a customer's purchase decision.
- Identify the products that have excess inventory so that you can make real-time recommendations to the customers based on the combination of category affinity and the excess inventory.

The scores, segments, and results from these models are used as inputs within IBM Analytical Decision Management by Alex the business analyst as he creates his business rules.

For more information, see "Personalized Promotions for Retail Customers predictive models" on page 20.

## Build cross-channel loyalty: In-store promotions

This example demonstrates how to use IBM Predictive Customer Intelligence to build cross-channel loyalty by using information gained from online activity to determine the best offers to use for customers in a physical store.

Billy Bauer walks into a physical store and purchases a Gamma Smart Phone-2090 Silver. He is also a registered customer in the online website. The web analytics tool recorded that he abandoned a cart to which he added a D2G Performance System (a computer). Billy gets a specialized discount for the computer, that is based on his buying behavior profile, In-Store Medium Value Offer Seeker, and the historical price sensitivity analysis for that cluster on the computers category. Billy is offered a price of $662.99, which is a 15 percent discount on the retail price of $779.99. This example highlights how data, which was collected from the customer's online browsing, can be effectively used to give an offer in the physical store, increasing cross-channel loyalty.

Ross Wilson walks into a store and purchases the same Gamma Smart Phone-2090. However, he is given a different offer than Billy Bauer. The offer is personalized, based on Ross's propensity to buy big screen TV products, MP3 players, and smartphones, and the profit that these offers generate based on the margin and propensity to purchase. The offer that Ross receives is for a discounted MP3 player. The MP3 player is part of the Monthly Specials Campaign, which is designed to sell products that are expected to have high inventory.

A third customer, Adrian Alba, who is identified by the Customer Lifetime Value model as a High Value Customer, is provided with 500 Loyalty points from the Rewards Campaign. This is predicted to make him a more loyal buyer.

### The campaign

Speakers and receivers have the highest amount of activity associated with them. The marketing manager sees that big screen TV products, smartphones, and MP3 players that have a high inventory are not selling. She decides to design campaigns to sell the big screen TV products, MP3 players, and smartphones, by using a retail promotions application that is developed in IBM Analytical Decision Management.

To clear the excess inventory in big screen TV products, MP3 players, and smartphones, the marketing manager decides to give discount coupons on those items. To select the appropriate people to receive the coupons, she uses the Category Affinity model, which is scored in batch to give out offers to customers whose propensity to purchase a product is more than 30%.

The Rewards Campaign is defined to reward customers based on their value to the retailer. Lifetime Value (LTV), which is an output of the Buying Behavior model, is used to determine whether a customer belongs to the High, Medium, or Low Value group. In each case, the customer is given 500, 200 or 100 loyalty points.

The Customized Pricing offer is used to give attractive discounts on products that the customer has abandoned in the online store. This example highlights how cross channel loyalty can be improved by detecting items that the customer abandoned online and then providing the customer with an offer on those items in the physical store.

The propensity to purchase for big screen TV products, MP3 players, and smartphones, is taken from the Category Affinity model.

The price and cost information for the products is based on actual numbers, while the rewards are based on a prediction of the customer's future purchases.

## Industry accelerator artifacts

The IBM Predictive Customer Intelligence Personalized Promotions for Retail Customers industry accelerator includes the following artifacts.

**IBM Cognos Business Intelligence reports**

> `PCI_Retail_Promotion_CognosContent.zip`
>
> `PCI_Retail_Promotion_FMProject.zip`
>
> The following reports are included:
> - Understanding the Customer
> - Market Basket Analysis
> - Customer Online Activity Analysis
>   - Purchase Activity Analysis
>   - All Online Activity Analysis
>   - Relative Activity Conversion Analysis
>   - Analyzing Online Activities by Customer Segments
>   - Analyzing Online Activities by Demographic Cluster
> - Customer Response Analysis
>
> The reports are described in Chapter 4, "Industry accelerator reports," on page 33.

**IBM Analytical Decision Management applications and templates**
> `PCI_Retail_Promotion_App.zip`

**Predictive models**

> `PCI_Retail_Promotion_CDS_Archive.pes`
>
> The individual stream files that are contained in the `pes` file are available in the `Streams` folder.
>
> The following streams are included:
> - `Category_Affinity_MBA_Segmentation.str`
> - `Category_Affinity_Target_Determination.str`
> - `Customer_Segmentation.str`
> - `Inventory_Based_Suggestion.str`

- `Market_Basket_Analysis Product Lines.str`
- `Market_Basket_Analysis_Export_to_Table.str`
- `Market_Basket_Analysis_Product_Recommendations.str`
- `Preprocessing_Data_Loading_Stream.str`
- `Price_Sensitivity.str`
- `Real_Time_Deployment_Browsing_Market_Basket_Analysis.str`
- `Real_Time_Deployment_Buying_Market_Basket_Analysis.str`
- `Real_Time_Deployment_Online_Behavior_Segmentation.str`
- `Real_Time_Deployment_Price_Sensitivity.str`
- `ResponseLog_Model.str`

The Predictive Models are described in "Personalized Promotions for Retail Customers predictive models" on page 20.

**IBM DB2® database**

`PCI_Retail_Promotion_Data.zip`

# Extend the accelerator with the IBM Predictive Customer Intelligence Usage Report

Optionally, you can monitor the effectiveness of your solution by using the IBM Predictive Customer Intelligence Usage Report. The IBM Predictive Customer Intelligence Usage Report displays the number of offers that are presented to customers and can be configured to show the number of offers that are accepted and rejected.

You can download the IBM Predictive Customer Intelligence Usage Report from IBM AnalyticsZone (www.ibm.com/analyticszone).

# Chapter 2. Industry accelerator installation

The Personalized Promotions for Retail Customers industry accelerator is for use with IBM Predictive Customer Intelligence.

The industry accelerator package contains the following parts:

- IBM DB2 databases.
- IBM Analytical Decision Management templates and applications.
- IBM SPSS project streams, models, and rules.
- IBM Cognos Business Intelligence reports and Framework Manager models and packages.

To install the industry accelerator, you must perform the following steps:

1. Download the industry accelerator from IBM AnalyticsZone (www.ibm.com/analyticszone).
2. Create the sample databases on the data node computer.
3. Install the Analytical Decision Management templates and applications on the Predictive Analytics node.
4. Import the SPSS project streams, models, and rules on the Predictive Analytics node.
5. Configure the data view for SPSS models on the Predictive Analytics node.
6. Install the IBM Cognos Content on the Business Intelligence node.

## Industry accelerator prerequisites

Before you install the industry accelerator, you must have a fully configured environment.

You must have administration rights and have the ability to copy files between computers.

## Download the industry accelerator

You must download the IBM Predictive Customer Intelligence accelerators from IBM AnalyticsZone.

### Procedure

1. Go to IBM AnalyticsZone (www.ibm.com/analyticszone).
2. Click **Downloads**, and under **Predictive Customer Intelligence Accelerators**, click **View all PCI downloads**.
3. Click **More details** for the accelerator that you want to download.
4. If you are not signed in, click **Sign In to Download**.

   You must enter your IBM ID. If you do not have an IBM ID, you must register to create one.
5. Click **Download**.
6. Go to the directory where you downloaded the industry accelerator.
7. Decompress the file.

# Creating the database

To use the IBM Predictive Customer Intelligence industry accelerator, you must create a database.

You run one script to create the database, and then run another script to populate the database.

## Procedure

1. Copy the industry accelerator database content file from the computer where you downloaded them to the data node computer:

   The Personalized Promotions for Retail Customers industry accelerator database file is `PCI_1.0_Retail_Promotion\Database\`
   `PCI_Retail_Promotion_Data.zip`. A database that is named `RETAIL` is created.

2. On the data node computer, decompress the file.

3. On Microsoft Windows operating systems, do the following steps:

   a. Log on to the data node computer as the DB2 instance owner user.

   b. Go to the folder where you decompressed the industry accelerator content files.

   c. In the uncompressed folder, double-click `Install_DB.bat`.

   d. Double-click `Load_Data.bat`.

4. On Linux operating systems, do the following steps:

   a. Log on to the data node computer as **root** user.

   b. Open a terminal window, and go to the directory where you decompressed the industry accelerator content files.

      **Note:** If you copied the content files to the home directory for the **root** user, you might have to move the files to another directory that is not in the **root** home directory so that you can run the scripts.

   c. Type the following command to change the permissions for the files:

      `chmod -R 755 *sh`

   d. Change to the database instance owner. For example, `su db2inst1`

   e. In the uncompressed folder, run `sh ./Install_DB.sh`.

   f. Run `sh ./Load_Data.sh`.

## What to do next

Verify that the tables are created and the data is successfully loaded into the input tables by checking the `out.log` file.

On Microsoft Windows operating systems, the log file is in the industry accelerator name folder. On Linux operating systems, the log file is in the `db2inst1` home folder.

Search for "rows were rejected" in the log file. The value should be zero, if it is not, there are data load issues.

# Installing Analytical Decision Management templates and applications

The IBM Predictive Customer Intelligence industry accelerator includes IBM Analytical Decision Management templates and applications. You must copy the template and application files to the Predictive Analytics node computer.

**Procedure**

1. Log on to the Predictive Analytics node computer.
2. From the computer where you downloaded the industry accelerator files, copy the Analytical Decision Management applications and templates files.
   - Application: `PCI_1.0_Retail_Promotion\Analytics\Applications\PCI_Retail_Promotion_App.zip`
   - Template: `PCI_1.0_Retail_Promotion\Analytics\Templates\Retail.xml`

   Copy the files to the `Applications` or `Templates` folder as appropriate on the Predictive Analytics node computer.

   On Microsoft Windows operating systems, the default locations are `C:\Program Files\IBM\SPSS\Deployment\6.0\Server\components\decision-management\Applications` and `C:\Program Files\IBM\SPSS\Deployment\6.0\Server\components\decision-management\Templates`.

   On Linux operating systems, the default locations are `/opt/IBM/SPSS/Deployment/6.0/Server/components/decision-management/Applications` and `/opt/IBM/SPSS/Deployment/6.0/Server/components/decision-management/Templates`.
3. Decompress the files in the `Applications` folder.
4. In a browser, go to the IBM Analytical Decision Management launch page: `http://`*`analytics_node_name`*`:`*`port_number`*`/DM`

   If you used the default values, the *port_number* is 9080.
5. Enter the log in credentials.
6. Click **Add application**, and select **Retail Promotions**.
7. Click **Save**.

## Importing IBM SPSS project streams, models, and rules

IBM SPSS project streams, models, rules, and other artifacts are contained in a repository export file (.pes) for the IBM Predictive Customer Intelligence industry accelerator. If you want to modify or view these artifacts, you must copy the export file to the computer where IBM SPSS Collaboration and Deployment Services Deployment Manager is installed, and open the file.

**Procedure**

1. From the computer where you downloaded the industry accelerator, copy the `.pes` file to the computer where IBM SPSS Collaboration and Deployment Services Deployment Manager is installed.

   The Personalized Promotions for Retail Customers industry accelerator file is `PCI_1.0_Retail_Promotion\Analytics\PCI_Retail_Promotion_CDS_Archive.pes`.
2. In IBM SPSS Collaboration and Deployment Service Deployment Manager, right-click **Content Repository**, and click **Import**.
3. Browse to the `.pes` file.
4. Select the following options:
   - **Resolve conflicts globally**
   - **Add new version of target item or rename source item**, **Use labels from source**.
   - **Continue import even if some objects cannot be imported due to locking conflicts**.
   - **Resolve Invalid Version Conflicts, Import**.

- **Resource Definitions, Recommended - Import if there are no Duplicate ID conflicts or Duplicate Name conflicts**.

5. Click **OK**.

### Results

Content folders and resource definitions are added to the repository alongside any existing content.

## Configuring the data view for IBM SPSS models

To configure the data view, IBM SPSS Modeler must be connected to the IBM Predictive Customer Intelligence industry accelerator database through an ODBC data source connection.

If your IBM Predictive Customer Intelligence environment uses the IBM SPSS Modeler client logged in to a Modeler server, perform the steps on the Predictive Analytics node computer (where IBM SPSS Modeler Server is installed).

If your IBM Predictive Customer Intelligence environment uses the IBM SPSS Modeler Client in a stand-alone environment, perform the steps on the client computer where IBM SPSS Modeler client is installed.

The Personalized Promotions for Retail Customers industry accelerator uses the Analytic Data View and JDBC source connections for accessing IBM Analytical Decision Manager. When the industry accelerator files are imported through IBM SPSS Collaboration and Deployment Services Deployment Manager, a new version of the Enterprise View is created that contains the tables for the industry accelerator.

### Procedure

1. Catalog the database on the client computer.
   a. Click **Start** > **IBM DB2** > **DB2COPY1 (Default)** > **DB2 Command Window - Administrator**.
   b. Enter the following command to catalog the database node:

      `db2 catalog tcpip node NODE_NAME remote data_node_name server PORT_NUMBER`

      *NODE_NAME* can be any value. *PORT_NUMBER* is 50000 by default.
   c. Enter the following command to catalog the PCI database:

      `db2 catalog database RETAIL at node NODE_NAME authentication server`

      You must use the same *node_name* that you used in the **db2 catalog database** command.
2. Create an ODBC DSN to point to the industry accelerator database. The database account that is provided in the ODBC connection must be the same user that was used for creating the tables.

   **Tip:** On Microsoft Windows operating systems, in the Windows Control Panel, select **Administrative Tools** and click **Data Sources**. Click the **System DSN** tab.
3. In the Deployment Manager client, under **Resource Definitions**, **Credentials**, open the **db2admin** credentials and update the user ID and password to the DB2 administrator account of the data node computer.
4. In **Resource Definitions**, **Data Sources**, open RETAIL_JDBC, and update the IP address and port number to point to the IBM Predictive Customer Intelligence data node computer. The default DB2 port number is 50000.

5. Open the data source, RETAIL_ODBC, and verify that the data source name corresponds to the ODBC name created for the industry accelerator. For example, RETAIL.
6. Verify that the Application View and the Data Provider Definition are working properly.
   a. Open RETAIL_CUSTOMER_ATTRIBUTES_DPD.
   b. Click **Validate**.
7. To retrieve a previous version of the Enterprise View, right-click **Enterprise View** in Deployment Manager and click **Open Version**.
8. To create a single view that combines the solution tables with any tables that existed previously, right-click **Enterprise View** in Deployment Manager and click **Merge Versions**.

## Configuring ODBC for IBM SPSS Modeler Server on Linux operating systems

To use an ODBC data source with IBM SPSS Modeler Server on a Linux operating system, you must configure the environment.

### Procedure

1. Stop the IBM SPSS Modeler Server.
2. Go to the `/root/SDAP71` directory.

   The driver files are installed as part of the IBM Predictive Customer Intelligence Server deployment.
3. Run the `setodbcpath.sh` script to update the ODBC path in the scripts.
4. Edit the `odbc.sh` script to add the definition for ODBCINI to the bottom of the script. For example:

   `ODBCINI=/usr/spss/odbc/odbc.ini; export ODBCINI`

   ODBCINI must point to the full file path of the `odbc.ini` file for IBM SPSS Modeler. The `odbc.ini` file lists the ODBC data sources that you want to connect to. A default `odbc.ini` file is installed with the drivers.
5. In the `odbc.ini` file, add the data source and specify the driver in the `[ODBC Data Sources]` section of the file.

   For example, add the data source as:

   ```
   [ODBC Data Sources]
   RETAIL=IBM DB2 ODBC Driver
   ```
6. In the `odbc.ini` file, create an ODBC data source connection for the industry accelerator database.

   For example, include the following content:

   ```
   [RETAIL]
   Driver=/opt/ibm/db2/V10.1/lib64/libdb2o.so
   DriverUnicodeType=1
   Description=IBM DB2 ODBC Driver
   ApplicationUsingThreads=1
   AuthenticationMethod=0
   BulkBinaryThreshold=32
   BulkCharacterThreshold=-1
   BulkLoadBatchSize=1024
   CharsetFor65535=0
   #Database applies to DB2 UDB only
   Database=RETAIL
   DefaultIsolationLevel=1
   DynamicSections=200
   EnableBulkLoad=0
   EncryptionMethod=0
   ```

```
FailoverGranularity=0
FailoverMode=0
FailoverPreconnect=0
GrantAuthid=PUBLIC
GrantExecute=1
GSSClient=native
HostNameInCertificate=
IpAddress=IP_Address_of_DB_server
KeyPassword=
KeyStore=
KeyStorePassword=
LoadBalanceTimeout=0
LoadBalancing=0
LogonID=db2inst1
MaxPoolSize=100
MinPoolSize=0
Password=password
PackageCollection=NULLID
PackageNamePrefix=DD
PackageOwner=
Pooling=0
ProgramID=
QueryTimeout=0
ReportCodePageConversionErrors=0
TcpPort=50000
TrustStore=
TrustStorePassword=
UseCurrentSchema=0
ValidateServerCertificate=1
WithHold=1
XMLDescribeType=-10
```

**Note:** You must use the driver library `libdb2o.so` with IBM SPSS Modeler.

Ensure that you set `DriverUnicodeType=1` to avoid buffer overflow errors when you connect to the database.

7. If you are using the 64-bit version of IBM SPSS Modeler Server, define and export `LD_LIBRARY_PATH_64` in the `odbc.sh` script:

```
if [ "$LD_LIBRARY_PATH_64" = "" ]; then
LD_LIBRARY_PATH_64=<library_path>
else
LD_LIBRARY_PATH_64=<library_path>:$LD_LIBRARY_PATH_64
fi
export LD_LIBRARY_PATH_64
```

Where `<library_path>` is the same as for the `LD_LIBRARY_PATH` definition in the script that was initialized with the installation path. For example, `/usr/spss/odbc/lib`.

**Tip:** You can copy the `if` and `export` statements for `LD_LIBRARY_PATH` in the `odbc.sh` file, append them to the end of the file. Then, replace the `LD_LIBRARY_PATH` strings in the newly appended `if` and `export` statements with `LD_LIBRARY_PATH_64`. Here is an example of the `odbc.sh` file for a 64-bit IBM SPSS Modeler Server installation:

```
if [ "$LD_LIBRARY_PATH" = "" ]; then
  LD_LIBRARY_PATH=/usr/spss/odbc/lib
else
  LD_LIBRARY_PATH=/usr/spss/odbc/lib:$LD_LIBRARY_PATH
fi
export LD_LIBRARY_PATH
if [ "$LD_LIBRARY_PATH_64" = "" ]; then
  LD_LIBRARY_PATH_64=/usr/spss/odbc/lib
else
  LD_LIBRARY_PATH_64=/usr/spss/odbc/lib:$LD_LIBRARY_PATH_64
```

```
fi
export LD_LIBRARY_PATH_64
ODBCINI=/usr/spss/odbc/odbc.ini; export ODBCINI
```

Ensure that you export `LD_LIBRARY_PATH_64`, and define it with the `if` loop.

8. Configure IBM SPSS Modeler Server to use the driver. Edit `modelersrv.sh` and add the following line immediately below the line that defines SCLEMDNAME:

   `. <odbc.sh_path>`

   Where `odbc.sh_path` is the full path to the `odbc.sh` file.

   For example: `. /usr/spss/odbc/odbc.sh`

   Ensure that you leave a space between the first period and the file path.

9. Save `modelersrv.sh`.

10. Configure the IBM SPSS Modeler Server to use the ODBC wrapper named `libspssodbc_datadirect.so`.

    a. Go to the `/usr/IBM/SPSS/ModelerServer/16.0/bin` directory.

    b. Remove the existing `libspssodbc.so` soft link by using the following command:

       `rm -fr libspssodbc.so`

    c. Link the new wrapper to `libspssodbc.so` by using the following command:

       `ln -s libspssodbc_datadirect_utf16.so libspssodbc.so`

11. Configure the db2cli.ini file in `<db2 instance home>`/sqllib/cfg/db2cli.ini to add the sections for each database.

    ```
    [RETAIL]
    Database=RETAIL
    Protocol=TCPIP
    DriverUnicodeType=1
    Port=50000
    Hostname=ip or hostname
    UID=username
    PWD=password
    ```

12. Save `odbc.ini`.

## What to do next

To test the connection, do the following steps:

1. Restart IBM SPSS Modeler Server.
2. Connect to IBM SPSS Modeler Server from a client.
3. Add a database source node to the canvas.
4. Open the node and verify that you can see the data source names that you defined in the `odbc.ini` file.

For additional information and troubleshooting tips for connecting to data sources, see the SPSS Modeler documentation (www.ibm.com/support/knowledgecenter/SS3RA7_16.0.0)

# Deploy the IBM Cognos content

For IBM Cognos Business Intelligence, you must catalog the database, create a data source connection, and then deploy the content files for the IBM Predictive Customer Intelligence industry accelerator.

## Moving the IBM Cognos content

You must copy the IBM Cognos content for the IBM Predictive Customer Intelligence industry accelerator to the appropriate locations in your IBM Cognos installation to be able to deploy the content.

### Procedure

1. Copy the IBM Cognos content from the computer where you downloaded the industry accelerator to the `Cognos_Install_location`\Deployment folder on the Business Intelligence node computer.

   The Personalized Promotions for Retail Customers industry accelerator IBM Cognos content file is `PCI_1.0_Retail_Promotion\BI\PCI_Retail_Promotion_CognosContent.zip`.

2. Copy the `PCI_Images` folder to the `Cognos_Install_location`\webcontent folder on the Business Intelligence node computer.

   You should have `Cognos_Install_location`\webcontent\PCI_Images folder that contains report image files.

3. Copy the IBM Cognos Framework Manager model files from the computer where you downloaded the industry accelerator to the computer where you installed IBM Cognos Framework Manager, and decompress the file.

   The Retail industry accelerator Framework Manager file is compressed in `PCI_1.0_Retail_Promotion\BI\PCI_Retail_Promotion_FMProject.zip`.

4. If you want to edit the Framework Manager models, you must catalog the industry accelerator database on the computer where you installed Framework Manager.

   a. Click **Start** > **IBM DB2** > **DB2COPY1 (Default)** > **DB2 Command Window - Administrator**.

   b. Enter the following command to catalog the database node:

      `db2 catalog tcpip node NODE_NAME remote data_node_name server PORT_NUMBER`

      `NODE_NAME` can be any value. `PORT_NUMBER` is 50000 by default.

   c. Enter the following command to catalog the PCI database:

      `db2 catalog database RETAIL at node NODE_NAME authentication server`

      You must use the same *node_name* that you used in the **db2 catalog database** command.

## Creating a data source connection to the industry accelerator database

You must create a data source connection to the IBM Predictive Customer Intelligence industry accelerator database.

### Procedure

1. Open a web browser.
2. Go to the IBM Cognos BI portal URL. For example, go to `http://bi_node_name/ibmcognos/`.
3. On the **Welcome** page, click **Administer IBM Cognos Content**.
4. Click the **Configuration** tab, and click **Data Source Connections**.
5. Click the **New Data Source** button .
6. In the **Name** box, type RETAIL, and then click **Next**.

7. In the connection page, select **IBM DB2**, ensure that **Configure JDBC connection** is selected, and click **Next**.
8. In the **DB2 database name** field, type RETAIL.
9. Leave **DB2 connect string** blank.
10. Under **Signons**, select both **Password** and **Create a signon that the Everyone group can use**, and then type the user ID and password for the DB2 instance owner user that you used to create the database, and click **Next**.

    **Tip:** To test whether the parameters are correct, click **Test the connection**. After you test the connection, click **OK** to return to the connection page.
11. In the **Server name** box, enter the name or IP address of your data node computer.
12. In the **Port number** box, enter the DB2 port number. The default is 50000.
13. In **Database name**, type RETAIL.

    **Tip:** To test whether the parameters are correct, click **Test the connection**. After you test the connection, click **OK** to return to the connection page.
14. Click **Finish**.

## Deploy the IBM Cognos reports

You must deploy the IBM Predictive Customer Intelligence industry accelerator reports using IBM Cognos Administration.

### Procedure
1. Open a web browser.
2. Go to the IBM Cognos BI portal URL. For example, go to http://*bi_node_name*/ibmcognos/.
3. On the **Welcome** page, click **Administer IBM Cognos Content**.
4. On the **Configuration** tab, click **Content Administration**.
5. On the toolbar, click the **New Import** button.
6. In the **Deployment Archive** pane, select deployment archive, and click **Next**.
   The deployment archive is named PCI_Retail_Promotion_CognosContent
7. In the **Specify a name and description** pane, accept the default or enter a new name, and click **Next**.
8. In the **Select the public folders and directory dontent** pane, select all of the packages in the table, leave the **Options** as default, and click **Next**.

   **Note:** Ensure that the **Disable after import** option is cleared.
9. In the **Specify the general options** pane, accept the defaults, and click **Next**.
10. On the **Review the summary** page, click **Next**.
11. On the **Select an action** page, select **Save and run once**, and click **Finish**.
12. On the **Run with options** page, accept the defaults, and click **Run**, and then click **OK**.
13. Select **View the details of this import after closing this dialog** and click **OK**.
14. In IBM Cognos Administration, click the **Home** button.
    The content is available in **Public Folders** > **PCI Industry Accelerators 1.0**.
15. In IBM Cognos Connections, click the **Public Folders** tab.
16. Click **IBM PCI Retail Portal Pages**.
17. For each of the reports, click 🔳 .

# Copying the industry accelerator license files to each computer

After you install the industry accelerator, you must copy the `license` folder to each computer on which you use the IBM Predictive Customer Intelligence industry accelerator.

**Important:** Do not rename the folders or files.

## Procedure

Copy the `license` folder from the folder where you decompressed the industry accelerator to each computer on which an IBM Predictive Customer Intelligence component is installed. For example, copy the folder and contents so that you have a `C:\IBM\PCI_IndustryAccelerators\1.0\license` folder on Microsoft Windows operating systems or an `/opt/IBM/PCI_IndustryAccelerators/1.0/license` folder on Linux operating systems on each node computer.
The folder contains the license files. The folder should exist on each server and client node computer.

# Chapter 3. Predictive models

Use IBM Predictive Customer Intelligence models to predict what is likely to happen in the future, based on patterns from past data.

For example, models can predict the following situations:

- How likely it is that a customer will churn in the next quarter.
- Whether a customer will be a promoter of a service, or a detractor
- How valuable the customer is in terms of future revenue

Models can be used in the same way as business rules. However, while rules might be based on corporate policies, business logic, or other assumptions, models are built on actual observations of past results, and can discover patterns that might not otherwise be apparent. While business rules bring common business logic to applications, models lend insight and predictive power. The ability to combine models and rules is a powerful feature.

## Model data sources

You or the administrator need to specify the data sources to use in the IBM Predictive Customer Intelligence solution for modeling, analysis, simulation and testing, and scoring.

Use IBM Analytical Decision Management to plan the model and to decide which data sources to use. You need the following types of data in the modeling process:

**Historical or analytical data**
> To build the model, you need information about what to predict. For example, if you want to predict churn, you need information about customers such as their complaints history, number of months since they upgraded their plan, sentiment score, demographic history, and estimated income. This is often referred to as historical data or analytical data, and it must contain some or all of the fields in the project data model, plus an additional field that records the outcome or result that you want to predict. This extra field is used as the target for modeling.

**Operational or scoring data**
> To use the model to predict future results, you need data about the group or population in which you are interested. This is often referred to as operational data or scoring data. The project data model is typically based on this data.

You can use the following types of data sources:

- A database that supports ODBC, such as IBM DB2.
- An Enterprise View that is defined in IBM SPSS Collaboration and Deployment Services.
- A file that is used by IBM SPSS Statistics, such as a text file (txt), or a comma separated file (csv).

When you add a new data source, map all of its fields to ensure compatibility with the project data model. For example, if the project data model requires a field named purchase with values Yes and No for the measurement level flag, then any

data source that you use must have a compatible field. If the field names are not identical, they can be mapped accordingly. Note that the input and associated mapped field must have the same data type.

You can characterize the information that each data field represents. Define a measurement level to determine how a given field is used in business rules, models, or other applications.

You can derive additional fields or attributes for the application by using the expression manager. For example, if you use banking data, you may want to create an expression that shows the ratio between a customer's income and the number of loan accounts that the customer has. Expressions are always numeric with a measurement of Continuous; this cannot be changed.

To enforce corporate-wide policies, use global selections to choose the records to include or exclude from processing by the application. Global selections can be particularly effective when used in combination with shared rules. Shared rules are saved as separate objects that can be used by multiple applications. If the shared rule changes, all applications that use the rule can then be updated.

Data mining that uses IBM SPSS Modeler focuses on the process of running data through a series of nodes. This is referred to as a stream. This series of nodes represents operations to be performed on the data, while links between the nodes indicate the direction of data flow. Typically, you use a data stream to read data into IBM SPSS Modeler, run it through a series of manipulations, and then send it to a destination, such as a table or a viewer.

For example, to open a data source, you add a new field, select records based on values in the new field, and then display the results in a table. In this example, your data stream would consist of the following nodes:
- Variable File node, which reads the data from the data source
- Derive node, which adds the new calculated field to the data set
- Select node, which uses the selection criteria to exclude records from the data stream
- Table node, which displays the results of your manipulations on screen

For more information about these features, see the IBM SPSS Modeler Help (www.ibm.com/support/knowledgecenter/SS3RA7_16.0.0/ com.ibm.spss.modeler.help/clementine/entities/clem_family_overview.htm).

# Personalized Promotions for Retail Customers predictive models

A number of predictive models are provided in the Personalized Promotions for Retail Customers industry accelerator.

The following models form the basis of the predictive models that are used:

**Customer Segmentation model**
The customer segmentation model (Customer_Segmentation.str) profiles customers through demographic segmentation, online behavior segmentation, and buying behavior segmentation.

**Market Basket Analysis models**
The market basket analysis models (Market_Basket_Analysis Product Lines.str, Market_Basket_Analysis_Export_to_Table.str, and Market_Basket_Analysis_Product_Recommendations.str) allow retailers to

gain insight into the product sales patterns by analyzing historical sales records and customers' online browsing behavior.

**Customer Affinity models**

The customer affinity models (`Category_Affinity_MBA_Segmentation.str` and `Category_Affinity_Target_Determination.str`) determine a customer's affinity towards product lines by understanding the customer demographic information, purchase information, and browsing information.

**Response Log Analysis model**

The response log analysis model (`ResponseLog_Model.str`) captures the response of customers and compares it with the recommendations that come from IBM Analytical Decision Management business rules.

**Price Sensitivity model**

The price sensitivity model (`Price_Sensitivity.str`) is the extent to which the price of a product affects a customer's purchase decision. The degree of price sensitivity varies from customer to customer, and from product to product.

**Inventory-Based Suggestion model**

The Inventory-Based Suggestion model (`Inventory_Based_Suggestion.str`) identifies the products that have excess inventory and then makes real-time recommendations to the customers based on the combination of category affinity and excess inventory.

**Real-time deployment models**

The following real-time deployment models are used by IBM Analytical Decision Management to create business rules to determine which actions are valid for a customer for online promotions or in-store promotions:

- `Real_Time_Deployment_Browsing_Market_Basket_Analysis.str`
- `Real_Time_Deployment_Buying_Market_Basket_Analysis.str`
- `Real_Time_Deployment_Online_Behavior_Segmentation.str`
- `Real_Time_Deployment_Price_Sensitivity.str`

**Pre-processing online data**

The pre-processing online data stream (`Preprocessing_Data_Loading_Stream.str`) processes the browsing behavior data from an online system and loads it into a database.

# Prepare data for a retail solution

Before data can be used in predictive models, process the online browsing data by using IBM SPSS Modeler streams.

## Pre-processing online data

Use a data pre-processing stream to process the browsing behavior data from an online system and load it into a database table in a format that is suitable for modeling analysis. Processing can be done in batch processing mode.

The example stream for pre-processing data is named `Preprocessing_Data_Loading_Stream.str`.

To obtain the online browsing behavior data, deploy a web analytics solution. Web analytics tools allow the flexibility to export the browsing behavior data in different formats such as a comma-separated file, which can then be used in IBM SPSS Modeler streams for further analysis. The data might include information

such as products browsed, products put into a cart, products abandoned, products that are purchased, pages that are viewed by customers, and the product category.

## Category affinity target determination

Affinity analysis is a data analysis and data mining technique that discovers co-occurrence relationships among activities that are performed by the customer to understand the purchase behavior of customers. The customer can have both an online and a physical presence. During online shopping, customers can browse, search, and view pages for different products before they make a purchase. The purpose of the Category Affinity model is to get information about product lines in which a customer is interested by understanding the online and buying behavior.

The stream for category affinity target determination that is included with the industry accelerator is named `Category_Affinity_Target_Determination.str`.

Use a category affinity target determination stream to process customer online and in-store historical transactional data to find out the following information:
- Products browsed
- Products purchased
- Products abandoned
- Products that are put in a cart
- Onsite searches
- Page views

The stream should process each activity separately so that you can prioritize the order of activity as purchase, browse, search, and page views.

Data should be processed in two steps:
1. Aggregation of the data should be done at the product line level so that you can get the number of items per product line for each customer activity.
2. Identify whether a customer has an affinity for a particular product line by comparing the number of items that are purchased in a category with the average number of items that are purchased by the total population.

    Some product lines are more likely to be purchased in large quantities while some other products would be purchased in small quantities. For example, a customer might buy many writable DVDs but they might buy a computer only once in three years. If you take the number of items or the value of items, the Category Affinity model would show a bias to a select few products.

Customers are likely to search products with different names, and might use related keywords or visit related pages. The pre-processing stream can process available data to get the corresponding product line information and derive the volume of items for each product line under this category.

When a customer searches a product with an exact product line name, a weight of one is assigned to that product line. However, when a customer searches for a super category, the number of product lines in that super category is determined and all the product lines in that super category are assigned equal weight. For example, a customer searches by the category named Consumer Electronics. It is not possible to know which product line the customer searched for because Consumer Electronics contains three product lines: Computers, MP3, and Smartphone. In such cases, all three product lines have a weight of $1/3 = 0.333333333$.

You can get more insight into customers from their purchase behavior than from their browsing behavior. Consider browsing behavior only when there is no purchase information. Likewise, if there is no browsing behavior, consider searching behavior, and if there is no searching behavior, consider page view information.

The formula for this example is shown:

```
if not(@NULL(Line_Purchased)) then Line_Purchased
elseif not(@NULL(Line_Browsed)) then Line_Browsed
elseif not(@NULL(Line_Search)) then Line_Search
elseif not(@NULL(Line_PageView)) then PageView
else "Default"
endif
```

In the industry accelerator, this derived information is stored in the intermediate database table: `RETAIL.CATEGORY_AFFINITY_OUTPUT`. This information is used as input into the logistic progression model in the `Category_Affinity_MBA_Segmentation.str` stream.

# Define customer segments

When you define customer segments, you profile the customers into groups that have similar demand characteristic, based on demographics, online behavior, and buying behavior. You use the segments to help you provide the right offer for the customer at the right time.

The example stream for defining customer segments in the IBM Predictive Customer Intelligence Personalized Promotions for Retail Customers industry accelerator is named `Customer_Segmentation.str`.

## Demographic segmentation

Demographic segmentation is based on age, gender, marital status, number of members in household, education, profession, and income. To get meaningful segments out of the data, missing information is derived based on the other variables. Continuous variables such as age and income are tiled into smaller number of groups.

When there are multiple variables to consider, clustering can be challenging. K-Means clustering can be used to cluster the customer base into distinct groups. Instead of trying to predict an outcome, K-Means clustering tries to uncover patterns from the demographic data that is provided as input. The clusters are formed in such a way that each customer within the segments is similar and different from customers present in other segments. Multiple iterations of K-Means clustering on the customer base are performed to arrive at six clusters to be used for targeting campaigns. Education, income, and marital status are the top three variables that determine the cluster in which a customer is categorized.

## Online behavior segmentation

Before online behavior segmentation can begin, the data must be prepared. Data preparation is described in "Prepare data for a retail solution" on page 21. This data is then aggregated to reveal trends in a particular session, and across sessions for an individual customer, and the total population.

The online browsing history is taken, and based on the aggregate information that is prepared in the data preparation stage, a TwoStep cluster model is developed.

The TwoStep clustering method is used because it can handle mixed field types and is able to handle large data sets efficiently. It can also test several cluster solutions and choose the best, so the number of clusters does not have to be set at the beginning of the process. Not having to set the number of clusters is an important feature because online data is dynamic in nature, and the algorithm that is used must be able to identify new clusters of users when they form. The TwoStep clustering method can be set to exclude unusual cases that can contaminate results. The clusters that are formed by the TwoStep clustering method depict the qualities of customers in the various stages of the online purchase funnel.

### Buying behavior segmentation

The purchase history of the customer, both online and in-store, is collected. Extra details that relate to the products purchased are also collected. The extra details might include: was the item purchased when there was an offer? What was the discount? What is the margin from selling the product? This information is used to derive multiple variables such as the average purchase value and average number of items that are purchased, across both channels and during discount and regular shopping.

The past purchase behavior helps to predict how likely a customer is to react to various kinds of offers. The past purchase behavior also helps to predict the kind of campaign that would be more suitable for the customer. Based on the online and in-store purchases that are made by the customers, and whether the purchases were made during an offer or at another time, a K-means clustering model is used to derive the various segments. The model identifies two clusters for primarily online customers, and three clusters for primarily in-store customers. For both online and in-store clusters, one segment is identified as offer hunters. Online offer hunters typically purchase high value items and in-store offer hunters typically purchase low value items. Non-offer hunters typically purchase high value items.

## Market basket analysis

Market basket analysis allows retailers to gain insight into the product sales patterns by analyzing historical sales records and customers' online browsing behavior.

Market basket analysis is used to increase marketing effectiveness and to improve cross-sell and up-sell opportunities by making the right offer to the right customer. For a retailer, good promotions translate into increased revenue and profits. The objectives of the market basket analysis models are to identify the next product that the customer might be interested to purchase or to browse.

Market basket analysis works on relating products in the historical transactions of a retailer. Association rules are generated by using the frequency of a particular item along with the combination of items. Rules with higher lift, confidence, and support are selected for deployment.

The example streams for market basket analysis have the following names:
- `Market_Basket_Analysis_Product_Recommendations.str`
- `Market_Basket_Analysis_Export_to_Table.str`
- `Market_Basket_Analysis Product Lines.str`

The inputs into the streams are the product and categories that are purchased and browsed. The output is used in IBM Analytical Decision Manager to provide an appropriate offer for a customer.

Market basket analysis for an online retailer requires two types of data: sales transaction data, and the customer's online browsing behavior data.

Online data that was prepared in the data processing step, provides the information on online purchase and browsing. For more information, see "Prepare data for a retail solution" on page 21. The in-store transaction tables provide the information on physical store purchase.

An apriori algorithm is used to find association rules between different product categories. Market basket analysis is done separately to find associations between products that are browsed, products purchased online, and products purchased in-store. Browsing behavior data is aggregated to get all the products purchased by a customer and all the products browsed by a customer. The apriori algorithm is then applied on the aggregated data to find the association between different product categories for the products that are purchased and the products that are browsed. For more information about the apriori algorithm, see the IBM SPSS Modeler User's Guide (www.ibm.com/support/knowledgecenter/SS3RA7_16.0.0/com.ibm.spss.modeler.help/clementine/understanding_modeltypes.htm?lang=en).

## Determine customer affinity

You can determine customer affinity towards product lines by understanding the customer demographic information, purchase information, and browsing information.

The example stream for determining product line affinity and product selection for customers in the IBM Predictive Customer Intelligence Personalized Promotions for Retail Customers industry accelerator is named `Category_Affinity_MBA_Segmentation.str`.

The input for the category affinity model is the output of the category affinity target determination model, the customer segmentation model, and online transactional data. The outputs from the models are stored in the intermediate database tables, and contain information about the product lines that customers are most interested in, the customer segments, and the customer market basket. This input is used by a logistic regression algorithm. Logistic regression is a statistical technique for classifying records that are based on values of input fields. A multinomial model is used because the target has multiple product lines. The model output is stored in the `CUSTOMER_SUMMARY_DATA` database table and is used in the IBM Analytical Decision Management application.

## Response log analysis

A response log captures the response of customers and compares it with the recommendations that come from IBM Analytical Decision Management business rules.

A response log gives a view of how many recommendations are taken up by customers in the form of offers that are accepted or offers that are declined. This information is logged in IBM SPSS Collaboration and Deployment Services systems tables in the form of XML response logs. The objective of the Response Log Analysis model is to discover the following information:
• The patterns of customers who are converted to Buyers.

- Which IBM Analytical Decision Management rules triggered high conversion rates to determine high impact business rules.

The example stream for the example Response Log Analysis model is named `ResponseLog_Model.str`.

The inputs are the product feedback log, and the response log.

The following models are used:
- Self-Learning Response Model (SLRM) algorithm
- Bayesian Network algorithm

Response log data is captured by the Response service. The Response service logs all the customer responses to IBM SPSS Collaboration and Deployment Services system tables in the form of XML tags. The log contains customer responses such as offers accepted, offers made, customer demographics, actual profit, IBM Analytical Decision Management rules for the offers that are accepted, and other metadata.

A similar method can be used to log product feedback that is given by customers in text format against each product line. This data is queried by XQuery, a query and functional programming language that queries collections of XML data. The data is then loaded into a view and used as a source of data for modeling.

The Self-Learning Response Model (SLRM) algorithm is used to predict the best offers to customers by using past responses to recommendations, and customer demographics. By using the SLRM node, you can build a model that continually updates, or re-estimates, as a data set grows without having to rebuild the model using the complete data set. This model predicts which offers are most appropriate for customers and predicts the probability of offer acceptance. The model predicts the best three offers for a customer. The model also analyses IBM Analytical Decision Management rules to determine which are the most effective rules.

## Inventory-based suggestion

Retailers often have the problem of excess inventory, where the value of the inventory depreciates rapidly due to the products becoming outdated. To prevent this problem, retailers use offers to clear the excess inventory. The inventory-based suggestion model identifies the products that have excess inventory and then makes real-time recommendations to the customers based on the combination of category affinity and excess inventory.

The example stream for the inventory-based suggestion model is named `Inventory_Based_Suggestion.str`.

The input to the model is transaction data from the online and physical store, and product details, including the current inventory. The output is the product name, and price and cost data to be made available to the customer.

The modeling techniques that are used are time series modeling, and inventory analysis by using IBM SPSS Modeler derive node functions.

### Forecasting inventory

You can predict the demand for products a week in advance.

Purchases that are made by the customers both in-store and online are aggregated by day, giving the information on demand for products daily. This information is used as an input for time series modeling. In the time series model, the expert option is selected so that IBM SPSS Modeler selects the best fitting model for each of the products, depending on their individual characteristics.

### Inventory cost analysis

You can calculate excess inventory and the holding cost. Excess inventory is determined by using the current stock, forecasted demand for the period in consideration, and the variation in demand.

```
Excess Inventory = Current Stock – Forecasted Demand –
    Z score required for the service level * Expected Variance in demand
```

Excess inventory is calculated a week in advance. The current stock is taken from the PACK SIZE variable in the product table. The forecasted demand for the next seven days is given out by the time series model. The standard deviation for a single day is calculated by using the aggregate node, which gives the values for standard deviation for all products. To get the variance over the length (seven days) the variance is multiplied by SQRT(7). The variance over a longer duration is an addition of the variance that is expected for each day, and standard deviation is the square root of variance. The holding cost is then taken to be 25% of the cost of all the products that are in excess inventory.

### Real-time recommendations

When a customer's data is entered in IBM Analytical Decision Manager, the product line to which the customer has the highest affinity is selected in real time. If there is a product in that product line that has excess inventory, that product is recommended to the customer. If the customer's affinity is with a product line that does not have excess inventory, then the default product, which has the highest holding cost across all product lines, is recommended to the customer.

## Deployment of models in the Personalized Promotions for Retail Customers industry accelerator

Scoring streams are based on the predictive models that are described in the Personalized Promotions for Retail Customers industry accelerator.

The scoring streams use the same input as the IBM Analytical Decision Management application.

There are three scoring streams:
- Online behavior segmentation.
- Browsing market basket analysis at a product level by customer.
- Buying market basket analysis at a product level by customer.

To perform market basket analysis, you must look up the price information in the product table or the product that comes out of the market basket analysis recommendation. In a real-time scoring service, this is not possible, so instead, scripts are used. Information, such as price and cost, is populated into look-up tables by using these scripts. There are two ways to run the script.
- You can run the script interactively in IBM SPSS Modeler by clicking **Tool** > **Stream properties** > **Execution**. The example script runs the product table output node that gives information on the product price, cost, and full item

name. The script then deletes the existing look-up tables and creates new look-up tables that are based on the product table output.

- You can run the script by creating a job and running the script by using the job URI through a web service.

## Example script to populate look-up tables

The following script provides an example of how to populate look-up tables. Modify this script for your environment.

```
########################################################################
# Variable Definition
########################################################################
var last_row
var i
########################################################################
delete Price:reclassifynode
execute PRODUCT_TABLE:tablenode
set last_row = PRODUCT_TABLE:tablenode.output.row_count

create reclassifynode connected between Type_Before and  Cost:reclassifynode
set Reclassify:reclassifynode.new_name = "Price"
set Price:reclassifynode.mode = Single
set Price:reclassifynode.replace_field = false
set Price:reclassifynode.field = "$A-30 fields-1"
set Price:reclassifynode.use_default = True
for i from 1 to ^last_row
 set "$A-30 fields-1"= value PRODUCT_TABLE:tablenode.output at ^i 1
 set Price   = value PRODUCT_TABLE:tablenode.output at ^i 4
 set Price:reclassifynode.reclassify.^"$A-30 fields-1" = ^Price
endfor

########################################################################
delete Cost:reclassifynode
execute PRODUCT_TABLE:tablenode
set last_row = PRODUCT_TABLE:tablenode.output.row_count

create reclassifynode connected between Price:reclassifynode and
 Full_Item_Name:reclassifynode
set Reclassify:reclassifynode.new_name = "Cost"
set Cost:reclassifynode.mode = Single
set Cost:reclassifynode.replace_field = false
set Cost:reclassifynode.field = "$A-30 fields-1"
set Cost:reclassifynode.use_default = True
for i from 1 to ^last_row
 set "$A-30 fields-1"= value PRODUCT_TABLE:tablenode.output at ^i 1
 set Cost   = value PRODUCT_TABLE:tablenode.output at ^i 3
 set Cost:reclassifynode.reclassify.^"$A-30 fields-1" = ^Cost
endfor

########################################################################
delete Full_Item_Name:reclassifynode
execute PRODUCT_TABLE:tablenode
set last_row = PRODUCT_TABLE:tablenode.output.row_count

create reclassifynode connected between Cost:reclassifynode and
 Full_Item_Name_With_Price
set Reclassify:reclassifynode.new_name = "Full_Item_Name"
set Full_Item_Name:reclassifynode.mode = Single
set Full_Item_Name:reclassifynode.replace_field = false
set Full_Item_Name:reclassifynode.field = "$A-30 fields-1"
set Full_Item_Name:reclassifynode.use_default = True
for i from 1 to ^last_row
 set "$A-30 fields-1"= value PRODUCT_TABLE:tablenode.output at ^i 1
 set Full_Item_Name   = value PRODUCT_TABLE:tablenode.output at ^i 2
 set Full_Item_Name:reclassifynode.reclassify.^"$A-30 fields-1" = ^Full_Item_Name
```

```
            endfor
```

##########################################################################

# Use Personalized Promotions for Retail Customers models in IBM Analytical Decision Management

In IBM Analytical Decision Management, you can combine predictive models with rules to allocate offers in accordance with business goals. You do this by combining selection and allocation rules that can be based on simple attributes such as age or job status, or based on the output from predictive models.

The IBM Analytical Decision Management application for the IBM Predictive Customer Intelligence Personalized Promotions for Retail Customers industry accelerator is named **Retail Promotions**, and is designed for campaign management in a retail scenario. It is shared by two IBM Analytical Decision Management models, one model for online promotions, and one model for in-store promotions.

## Online promotions

For online promotions, campaigns are designed to target specific customer segments.

The data that is used by the application includes demographic, behavioral data, and purchase history, and attributes such as segment membership and category affinity that are derived from predictive models.

## In-store promotions

For in-store promotions, campaigns are organized around business objectives, such as reducing inventory through special promotions or rewarding the most loyal customers.

## Input to the IBM Analytical Decision Management application

The IBM Analytical Decision Management application uses the output of the following predictive models as input:

**Category affinity model output**
    The probability that the customer likes a particular product line.

**Segmentation model output**
    The demographic, online behavior, and buying behavior segment outputs.

**Market basket analysis output**
    The output of market basket analysis that is based on browsing and purchase.

# Training predictive models

Predictive models must be trained to determine which data is useful and which data is not needed. When a model gives you accurate predictions, you are ready to use the predictive model for real-time scoring.

You use a training data set to build the predictive model and a test set of data to validate the model that was created with the training set.

Models must be retrained periodically with new data sets to adjust for changing behavior patterns. For information about using IBM SPSS Modeler, see IBM SPSS Modeler Help (www.ibm.com/support/knowledgecenter/SS3RA7_16.0.0/com.ibm.spss.modeler.help/clementine/entities/clem_family_overview.htm?lang=en).

## Scoring a model

To score a model means to apply it to some data in order to obtain a result or prediction that can be used as input to decisions.

Depending on the application, the scoring results can be written to a database table or flat file, or used as inputs to the segment, selection, and allocation rules that drive decisions in an application.

For more information, see IBM SPSS Collaboration and Deployment Services Deployment Manager User's Guide (www.ibm.com/support/knowledgecenter/SS69YH_6.0.0/com.spss.mgmt.content.help/model_management/thick/scoring_configuration_overview.html).

## Create business rules

For IBM Predictive Customer Intelligence, you use IBM Analytical Decision Management to bring together your company's business rules, predictive models, and optimizations.

Using IBM Analytical Decision Management, the insights gained through predictive modeling can be translated to specific actions.

You can combine predictive models with rules to allocate offers in accordance with business goals. This is done by using a combination of selection and allocation rules that are based on the output from predictive models.

The steps that you take are:

**Define possible actions**
If a customer is not happy with a service, what should you do about it.

**Allocate offers**
Which types of customers are the best candidates for which offers.

**Prioritize offers**
Prioritization determines which offers a customer receives.

For more information, see the IBM Analytical Decision Management Application User's Guide (www.ibm.com/support/knowledgecenter/SS6A3P_8.0.0/com.ibm.spss.dm.userguide.doc/configurableapps/dms_define_rules.htm).

## Deploy an application

You can deploy the IBM Predictive Customer Intelligence application to a testing environment or to a production environment, such as a call center or a website. You can also deploy it to contribute to batch processing.

You can deploy a stream in the IBM SPSS Modeler repository. A deployed stream can be accessed by multiple users throughout the enterprise and can be

automatically scored and refreshed. For example, a model can be automatically updated at regularly scheduled intervals as new data becomes available.

For more information, see IBM SPSS Collaboration and Deployment Services (www.ibm.com/support/knowledgecenter/SS69YH_6.0.0/ com.spss.mgmt.content.help/model_management/_entities/ whatsnew_overview_thick.html?cp=SS69YH_6.0.0%2F5).

# Chapter 4. Industry accelerator reports

An IBM Cognos Business Intelligence report is provided with the IBM Predictive Customer Intelligence industry accelerator.

You can customize the report by using IBM Cognos Report Studio. Report Studio is a report design and authoring tool. Report authors can use Report Studio to create, edit, and distribute a wide range of professional reports. For more information, see IBM Cognos Report Studio User Guide (www.ibm.com/support/knowledgecenter/ SSEP7J_10.2.1/com.ibm.swg.ba.cognos.ug_cr_rptstd.10.2.1.doc/ c_rs_introduction.html).

The metadata that the report displays comes from the package that is created in and published from IBM Cognos Framework Manager. The example Framework Manager project folder contains the compiled project file (`.cpf`). When you open the `.cpf` file, Framework Manager displays the modeled relationships of the data and the package definitions, which are made available to the reporting studios when published. You can modify the metadata for the report by using Framework Manager. For more information, see IBM Cognos Framework Manager User Guide (www.ibm.com/support/knowledgecenter/SSEP7J_10.2.1/ com.ibm.swg.ba.cognos.ug_fm.10.2.1.doc/c_ug_fm_introduction.html %23ug_fm_Introduction).

## Available reports

The following IBM Predictive Customer Intelligence portal pages are from the IBM Cognos Business Intelligence portal.

**Customer Online Activity Analysis**
Shows detailed analysis of the customer's online activities with the following charts:
- Purchase Activity Analysis (Traditional) shows a distribution of purchase activities across different product lines.
- All Online Activity Analysis shows a relative comparison of all online activities for all product lines.
- Relative Activity Conversion Analysis shows a stacked chart to analyze the conversions between different online activities, such as Page Views, Products Browsed, Products Carted, Products Abandoned, Products Purchased, for all product lines.
- Analyzing Online Activities by Customer Segments allows you to analyze the online activities for different customer segments and combinations of customer segments.
- Analyzing Online Activities for Demographic Cluster shows a detailed analysis of online activities for a demographic cluster. For example, for a selected product line which cluster has highest products browsed activity.

**Customer Response Analysis**
Contains two charts that are based on the data available from a customer's response to product satisfaction and various offers that were made through the IBM Analytical Decision Management application.

Contains a dial chart that shows how the customers rated a particular product line or a product. It also contains a column chart that shows the relative comparison of the probability of accepting different offers.

**Market Basket Analysis**
Shows the products that are likely to be bought together. This report can also be filtered for individual products.

**Understanding the Customer**
Shows a distribution of a customer's online activities across different product lines, and customer segmentation. Customer segments are shown by using a customer's demographic data, online activity data, and their purchasing behavior.

# View IBM Predictive Customer Intelligence reports

You can view the IBM Predictive Customer Intelligence industry accelerator report in IBM Cognos Business Intelligence.

## Procedure

1. Open a web browser.
2. Go to the IBM Cognos BI portal URL. For example, go to `http://`*`bi_node_name`*`/ibmcognos/`.
3. In the **IBM Cognos Welcome** page, click **IBM Cognos content**.
4. In the **Public Folders** tab, click: **PCI Industry Accelerators 1.0**.

# Modify the data model

You use IBM Cognos Framework Manager to model the meta data for the IBM Predictive Customer Intelligence industry accelerator reports.

IBM Cognos Framework Manager is a meta data modeling tool that drives query generation for IBM Cognos software. A model is a collection of meta data that includes physical information and business information for one or more data sources.

For information on modifying or creating Framework Manager models, see the *IBM Cognos Framework Manager User Guide*. This is available from IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSEP7J_10.2.1/com.ibm.swg.ba.cognos.cbi.doc/welcome.html).

## Procedure

1. Launch IBM Cognos Framework Manager.
2. Click **Open a Project** and browse to the location where you copied and decompressed the IBM Cognos Framework Manager model file.

   The Retail industry accelerator IBM Cognos Framework Manager files are `PCI_Retail_Promotion_FMProject\Customer Activities BI Model\Customer Activities BI Model.cpf` and `PCI_Retail_Promotion_FMProject\Customer Response BI Model\Customer Response BI Model.cpf`.

# Appendix. Troubleshooting a problem

Troubleshooting is a systematic approach to solving a problem. The goal of troubleshooting is to determine why something does not work as expected and how to resolve the problem.

Review the following table to help you or customer support resolve a problem.

*Table 1. Troubleshooting actions and descriptions*

| Actions | Description |
|---------|-------------|
| A product fix might be available to resolve your problem. | Apply all known fix packs, or service levels, or program temporary fixes (PTF). |
| Look up error messages by selecting the product from the IBM Support Portal, and then typing the error message code into the **Search support** box (http://www.ibm.com/support/entry/portal/). | Error messages give important information to help you identify the component that is causing the problem. |
| Reproduce the problem to ensure that it is not just a simple error. | If samples are available with the product, you might try to reproduce the problem by using the sample data. |
| Ensure that the installation successfully finished. | The installation location must contain the appropriate file structure and the file permissions. For example, if the product requires write access to log files, ensure that the directory has the correct permission. |
| Review all relevant documentation, including release notes, technotes, and proven practices documentation. | Search the IBM Knowledge Center to determine whether your problem is known, has a workaround, or if it is already resolved and documented. |
| Review recent changes in your computing environment. | Sometimes installing new software might cause compatibility issues. |

If the items in the table did not guide you to a resolution, you might need to collect diagnostic data. This data is necessary for an IBM technical-support representative to effectively troubleshoot and assist you in resolving the problem. You can also collect diagnostic data and analyze it yourself.

# Troubleshooting resources

Troubleshooting resources are sources of information that can help you resolve a problem that you are having with an IBM product.

## Support Portal

The IBM Support Portal is a unified, centralized view of all technical support tools and information for all IBM systems, software, and services.

The IBM Support Portal lets you access all the IBM support resources from one place. You can tailor the pages to focus on the information and resources that you need for problem prevention and faster problem resolution. Familiarize yourself

with the IBM Support Portal by viewing the demo videos (https://www.ibm.com/blogs/SPNA/entry/the_ibm_support_portal_videos).

Find the content that you need by selecting your products from the IBM Support Portal (http://www.ibm.com/support/entry/portal).

Before contacting IBM Support, you will need to collect diagnostic data (system information, symptoms, log files, traces, and so on) that is required to resolve a problem. Gathering this information will help to familiarize you with the troubleshooting process and save you time.

## Service request

Service requests are also known as Problem Management Reports (PMRs). Several methods exist to submit diagnostic information to IBM Software Technical Support.

To open a PMR or to exchange information with technical support, view the IBM Software Support Exchanging information with Technical Support page (http://www.ibm.com/software/support/exchangeinfo.html).

## Fix Central

Fix Central provides fixes and updates for your system's software, hardware, and operating system.

Use the pull-down menu to navigate to your product fixes on Fix Central (http://www.ibm.com/systems/support/fixes/en/fixcentral/help/getstarted.html). You may also want to view Fix Central help.

## IBM developerWorks

IBM developerWorks® provides verified technical information in specific technology environments.

As a troubleshooting resource, developerWorks provides easy access to the most popular practices, in addition to videos and other information: developerWorks (http://www.ibm.com/developerworks).

## IBM Redbooks

IBM Redbooks® are developed and published by the IBM International Technical Support Organization, the ITSO.

IBM Redbooks (http://www.redbooks.ibm.com) provide in-depth guidance about such topics as installation and configuration and solution implementation.

## Software support and RSS feeds

IBM Software Support RSS feeds are a quick, easy, and lightweight format for monitoring new content added to websites.

After you download an RSS reader or browser plug-in, you can subscribe to IBM product feeds at IBM Software Support RSS feeds (https://www.ibm.com/software/support/rss).

## Log files

Log files can help you troubleshoot problems by recording the activities that take place when you work with a product.

## Error messages

The first indication of a problem is often an error message. Error messages contain information that can be helpful in determining the cause of a problem.

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