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Keeping Hope Afloat: How to Prevent Financial Loss amongst a Sea of Online Pirates

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ABSTRACT

Gone are the days when the only method of receiving a loan was by visiting your local branch and working with a loan officer. In today's economy, financial institutions are increasingly relying on online channels to interact with their customers. The anonymity that is inherent in this channel makes it a prime target for fraudsters. The solution is to profile the behavior of Internet banking in real time and risk-assess each transaction as it is processed in order to prevent financial loss before it occurs. SAS® Visual Scenario Designer enables you to create rules, scenarios, and models, test their impact, and inject them into real-time transaction processing using SAS® Event Stream Processing.

INTRODUCTION

The financial services industry is currently undergoing a dramatic shift toward digitalization as it tries to both reduce costs and satisfy increasingly tech-savvy customers who demand instant, online, and remote access to banking services. The expansion of Internet banking has led to many new fraud and cyber-crime challenges as online fraudsters discover and exploit weak defenses in these new channels. In addition, organizations struggle to keep up with the demands for data analysis due to increasing volumes of online transactions and the need for real-time decisioning.

With such challenges at hand, you must use a sophisticated analytical system, capable of effectively analyzing large data volumes, to prevent financial loss. Traditional anti-fraud systems are not able to keep up with the changing demands of online banking system for the following reasons:

- It is difficult to introduce new profiles and metrics, which might hold the key to uncovering new patterns of fraud.
- Fraudsters can adapt quickly, out-pacing the long lead times that are typically associated with introducing new models.
- Ineffective models or ones that produce a high percentage of false positives lead to bad customer experiences or high operational costs.

SAS is making analytics approachable, providing you with insights into data and allowing you to constantly discover new patterns of fraud and then use the findings in your operational systems. SAS® Visual Scenario Designer enables you to structure data for analytics and then create rules and models that detect anomalous behavior associated with fraud. In addition, SAS Visual Scenario Designer uses SAS® LASR™ Analytic Server to enable fast and distributed analysis of the large volumes of online transactions. SAS® Event Stream Processing takes the rules and models developed in SAS Visual Scenario Designer and inserts them into the online transaction stream delivering real-time decisioning. The combination of SAS Visual Scenario Designer and SAS Event Stream Processing addresses all of shortcomings of traditional anti-fraud systems mentioned above.

This paper examines how you can combat online fraud and the benefits that SAS Visual Scenario Designer brings to your organization in that effort.

ONLINE TRANSACTIONS

The examples in this paper are derived from data collected during thousands of online banking sessions where users performed various activities, the majority of which are normal. A very small percentage of these transactions is associated with online fraud, and our goal is to stop future transactions that share similar patterns with fraudulent ones. The data is described in Table 1. Online Transaction Example Data:

Field name	Type	Role
TRANSACTION_ID	CHARACTER	Key
TRANS_TYPE	CHARACTER	
PRODUCT_TYPE	CHARACTER	
PAYEE_CUST_ID	CHARACTER	Profile Group By
PAYEE_ACCOUNT_NUMBER	CHARACTER	
AMOUNT	NUMERIC	Measure
BENEFICIARY_ACCOUNT_NUMBER	CHARACTER	Profile Group By
IP_ADDRESS	CHARACTER	Profile Group By
SESSION_ID	NUMERIC	
TRANSACTION_DATETIME	DATETIME	Time
NEW_BENEFICIARY	BOOLEAN	
COUNTRY_CODE	CHARACTER	
COUNTRY_NAME	CHARACTER	
TRANSACTION_ORIGIN	CHARACTER	
CONFIRMED_FRAUD	BOOLEAN	Target
ACCOUNT_STATUS	CHARACTER	
BROWSER	CHARACTER	

Table 1. Online Transaction Example Data

METHODOLOGY

In order to prepare the data for predictive analytics and what-if hypothesis testing, you must first create profiles or aggregations across elements of interest. For the online transactional data described above, create three profiles outlined in Table 2. Example Profiles:

Profile	Group By	Events / Metrics collected
Customer profile	PAYEE_CUST_ID	Number of transactions Number of beneficiaries Number of logons Number of foreign logons
IP profile	IP_ADDRESS	Number of customers Number of transactions Number of fraudulent transactions
Beneficiary profile	BENEFICIARY_ACCOUNT_NUMBER	Number of customers Number of transactions Number of fraudulent transactions

Table 2. Profiles

Next, combine the transactional data with the profile results as illustrated in Figure 1:

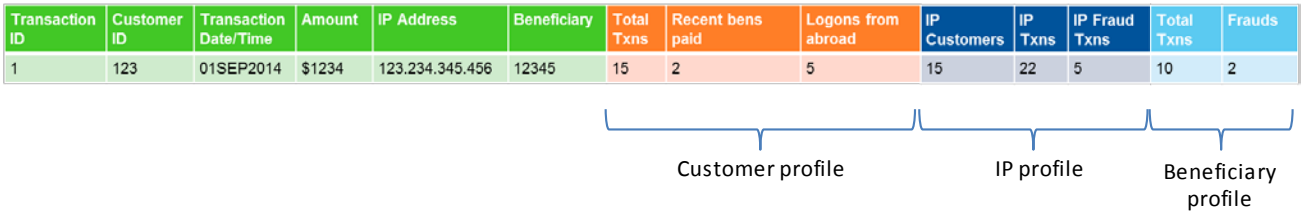


Figure 1 Combine Profile and Transactional Data

Now, you can identify patterns like the following that match the business hypothesis:

- first time this customer has logged on from abroad and attempted a high-value transaction
- recently paid, multiple beneficiaries from an IP that has had previous fraudulent transactions

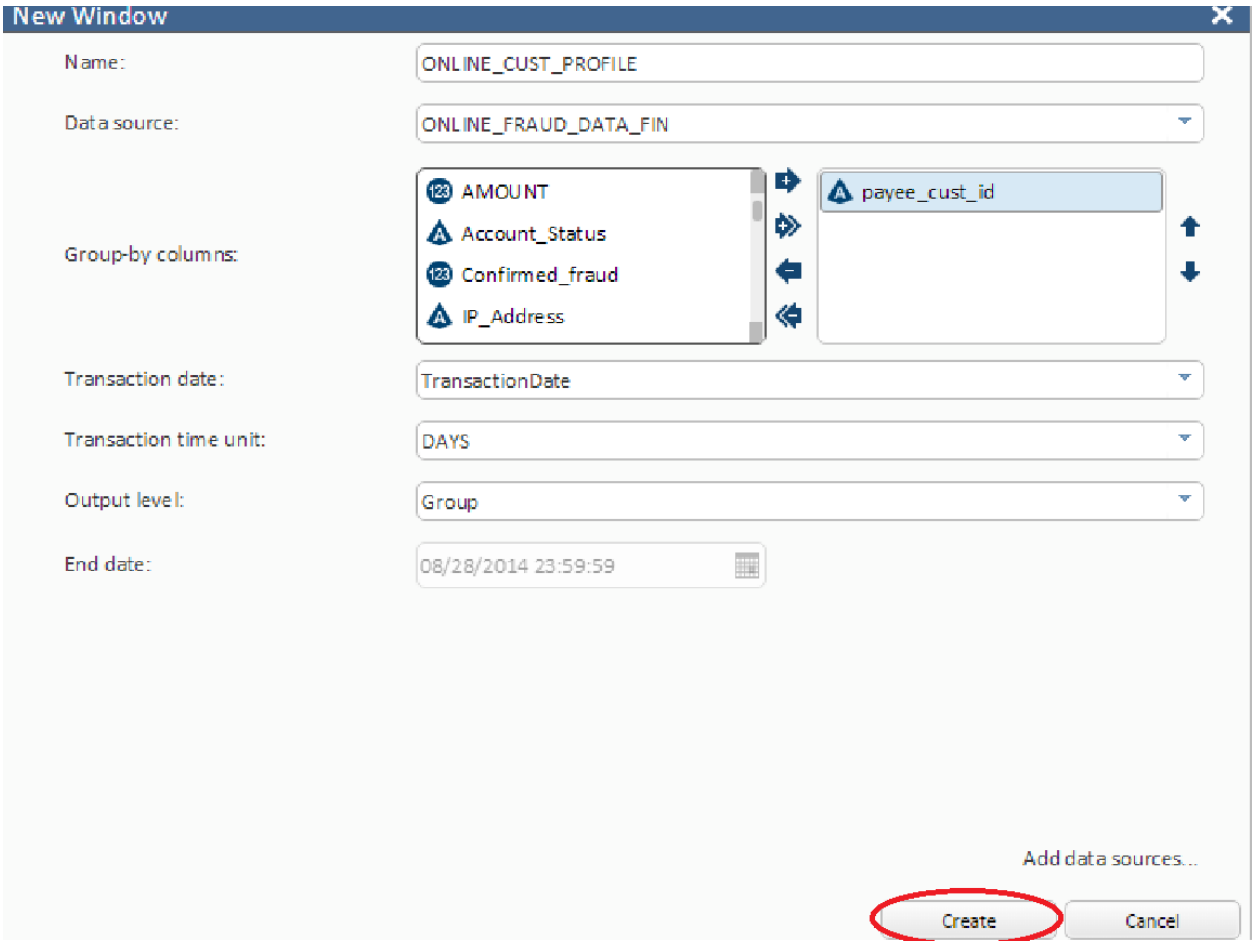
You can also use machine-learning techniques to identify the likelihood of future fraud.

SAS VISUAL SCENARIO DESIGNER

SAS Visual Scenario Designer enables you to create data-driven scenarios that accurately identify events or detect patterns of interest. To aid pattern discovery and to write rules against the patterns, the application uses SAS LASR Analytic Server input to aggregate specified data fields.

In this section, we illustrate how you can use SAS Visual Scenario Designer to create the profiles outlined in Table 2, and then combine them with the original transaction data.

Starting with the data described in Table 1. Online Transaction Example Data, create a new aggregate window for customer profile as illustrated in Displays 1-2:

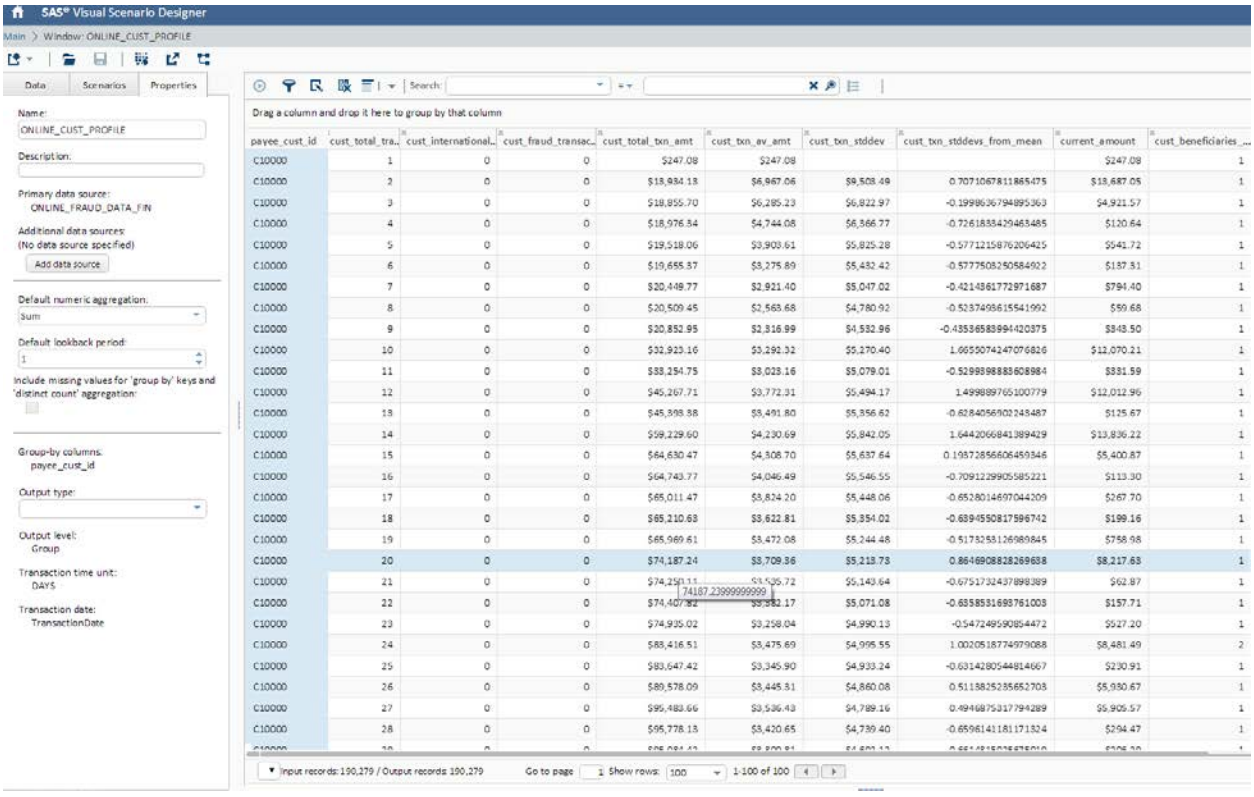


Display 1. Create a Customer Profile Window

Then, add new computed columns to profile the behavior of the customer up to the point of the transaction. You can start with the columns outlined in Table 3. Example Customer Profile Columns:

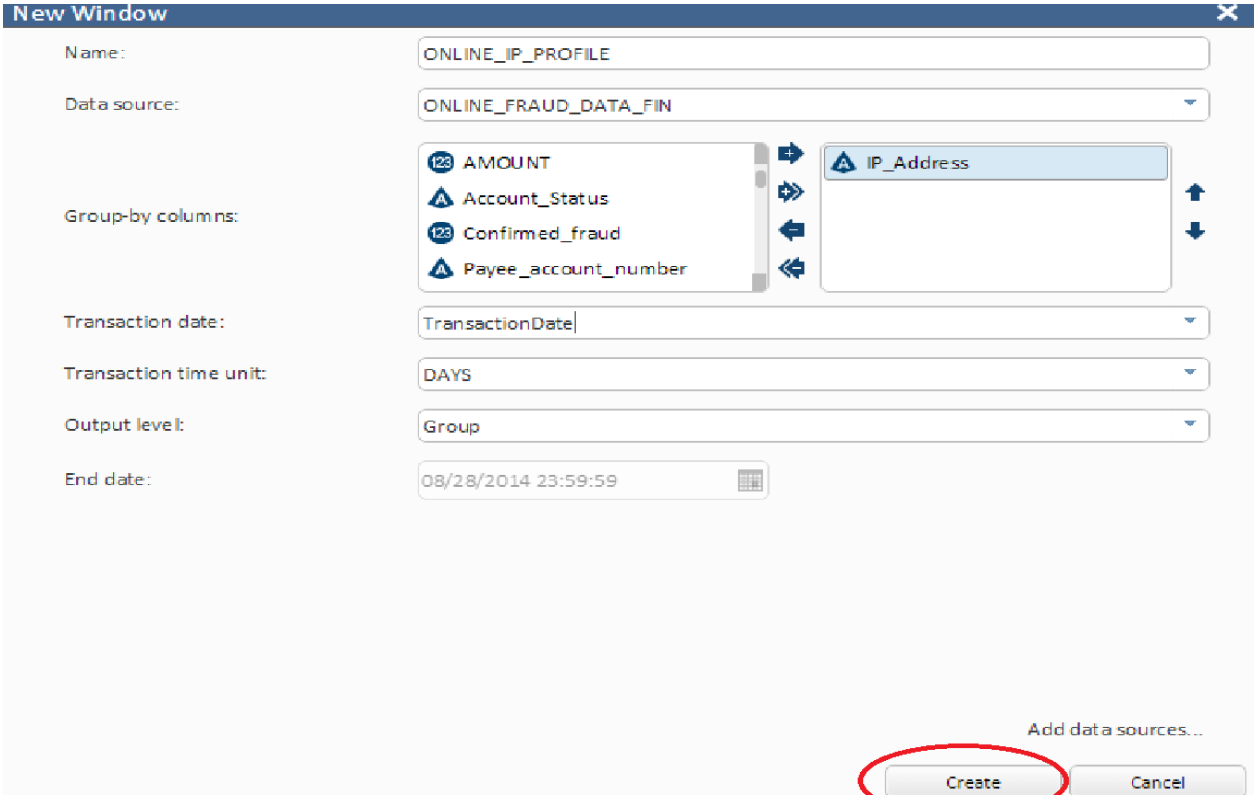
Column	Metric	Conditions
CUST_TOTAL_TRANSACTIONS	Count	None
CUST_INTERNATIONAL_TRANSACTIONS	Count	TRANSACTION_ORIGN="INTERNATIONAL"
CUST_FRAUD_TRANSACTIONS	Count	CONFIRMED_FRAUD="1"
CUST_TOTAL_TXN_AMT	Sum of AMOUNT	None
CUST_TXN_AV_AMT	Average of AMOUNT	None
CUST_TXN_STD_AMT	Standard Deviation of AMOUNT	None

Table 3. Example Customer Profile Columns



Display 2. Customer Profile Window

Next, create a new aggregate window for IP Profile as illustrated in Displays 3-4:

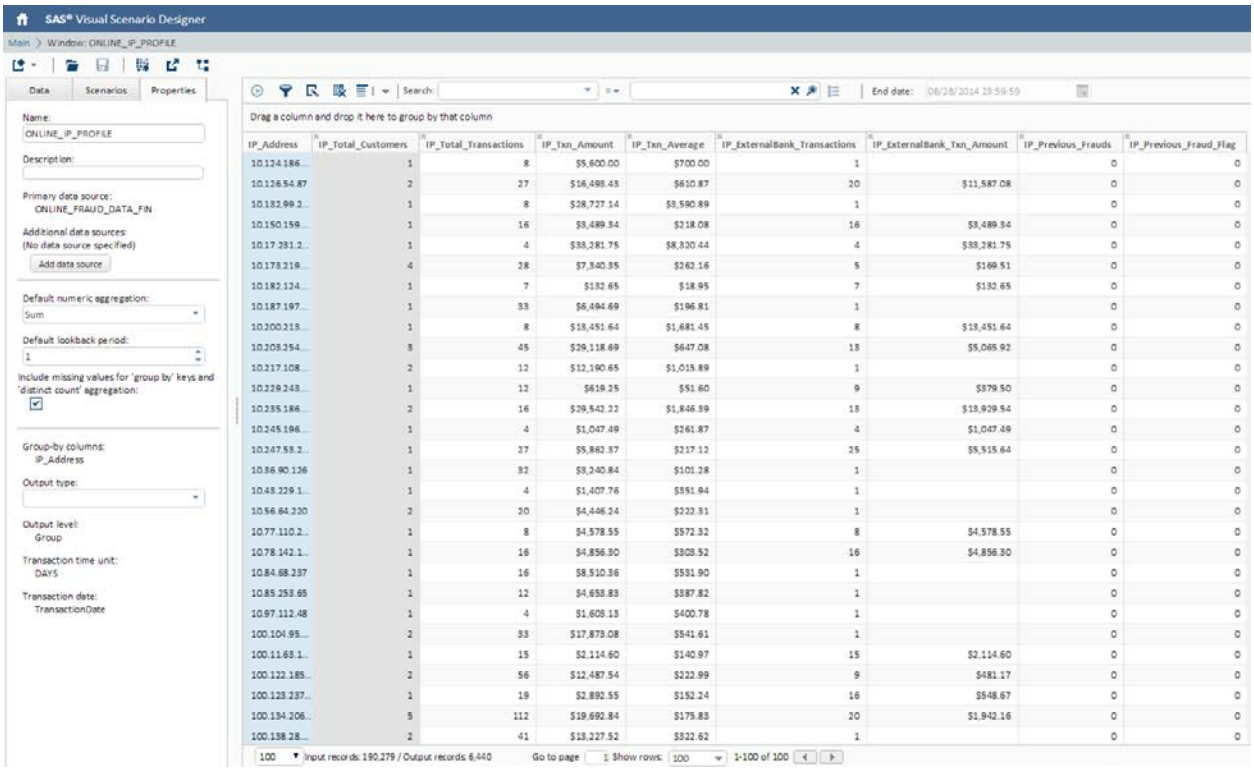


Display 3. Create an IP Profile Window

Then, add new computed columns to profile the transactions coming from the same IP address up to the point of the transaction. You can start with the columns outlined in Table 4. Example IP Profile Columns:

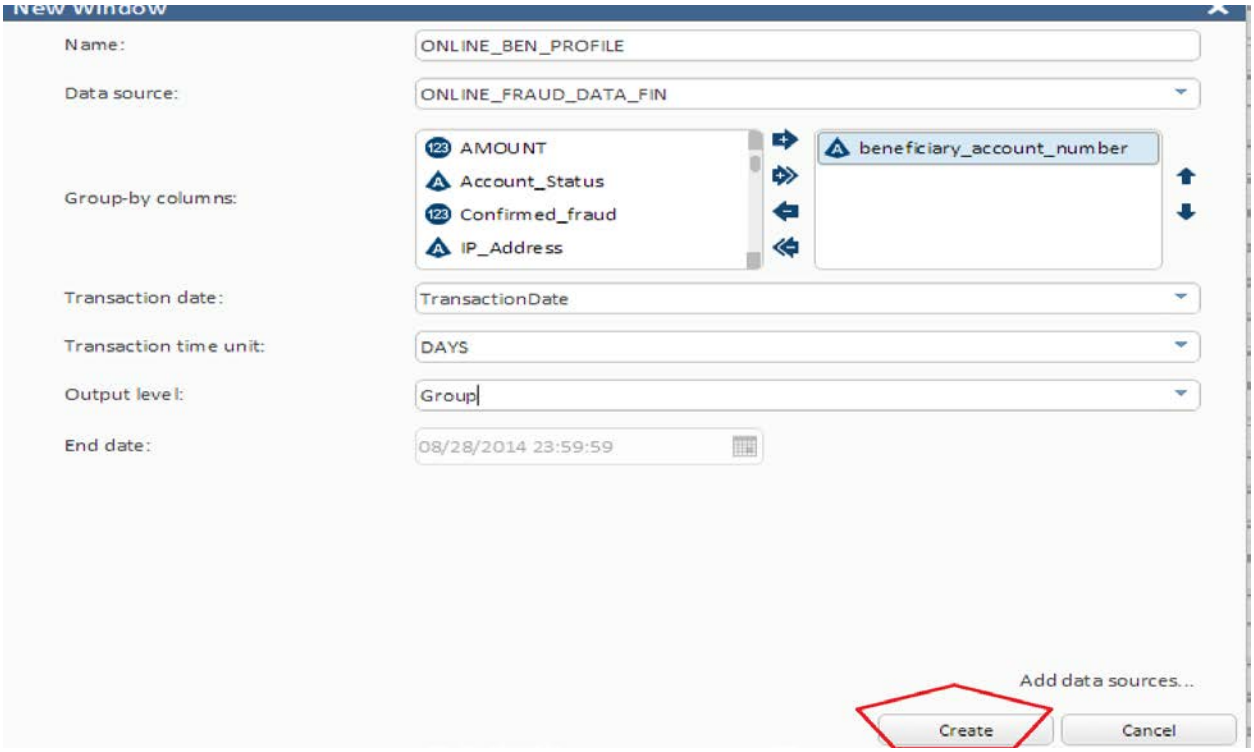
COLUMN	Metric	Conditions
IP_TOTAL_CUSTOMERS	Distinct Count of PAYEE_CUST_ID	None
IP_TOTAL_TRANSACTIONS	Count	None
IP_TXN_AMOUNT	Sum of AMOUNT	None
IP_TXN_AVERAGE	Average of AMOUNT	None
IP_EXTERNALBANK_TRANSACTIONS	Count	TRANS_TYPE = "EXTERNAL BANK"
IP_EXTERNALBANK_TXN_AMOUNT	Sum of AMOUNT	TRANS_TYPE = "EXTERNAL BANK"
IP_FRAUD_TRANSACTIONS	Count	CONFIRMED_FRAUD="1"

Table 4. Example IP Profile Columns



Display 4. IP Profile Window

Next, create a new aggregate window for Beneficiary Profile as illustrated in Displays 5-6:

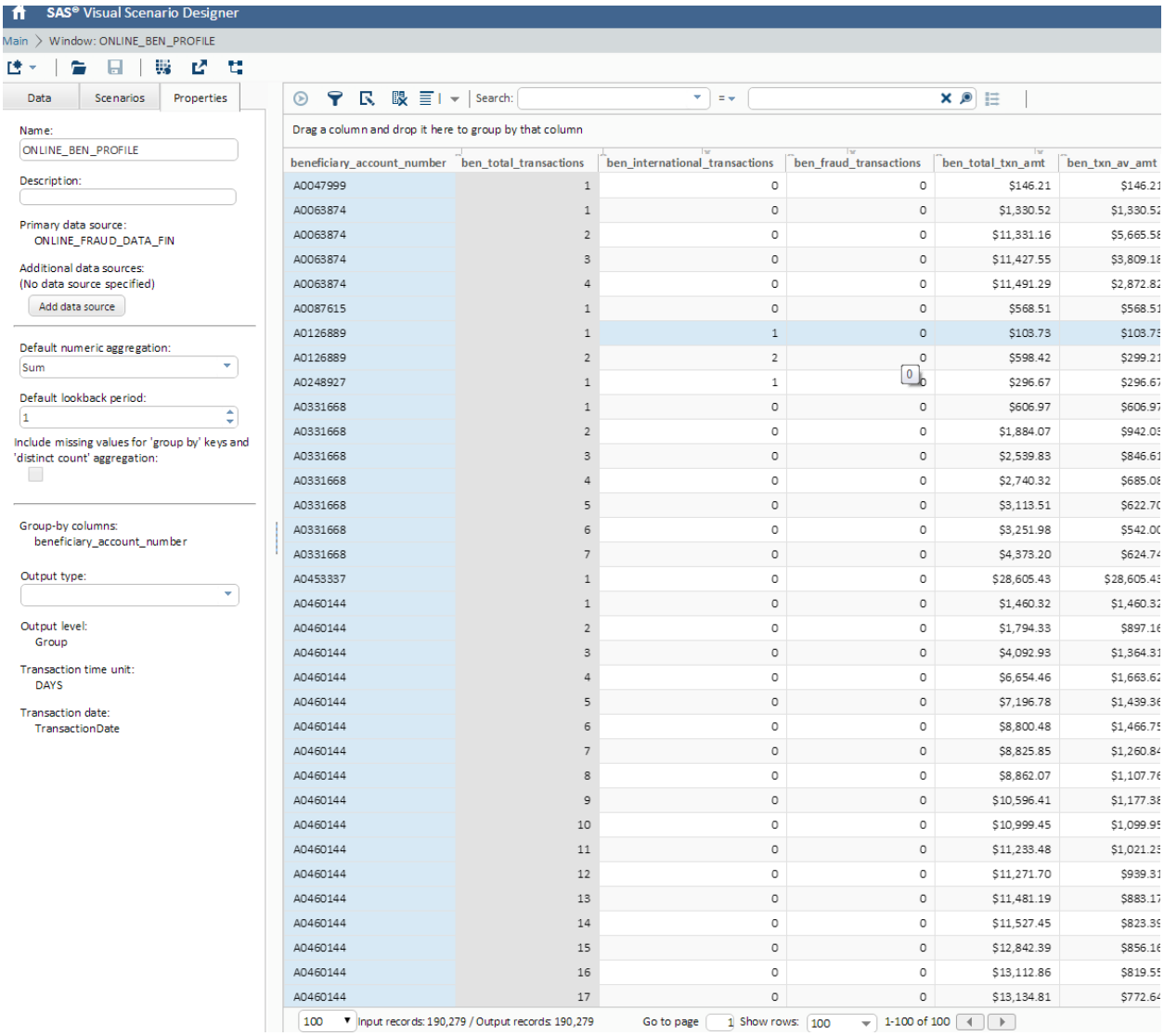


Display 5. Create a Beneficiary Profile Window

Then, add new computed columns to profile the transactions targeting the same beneficiary up to the point of the transaction. You can start with the columns outlined in Table 5. Example Beneficiary Profile Columns:

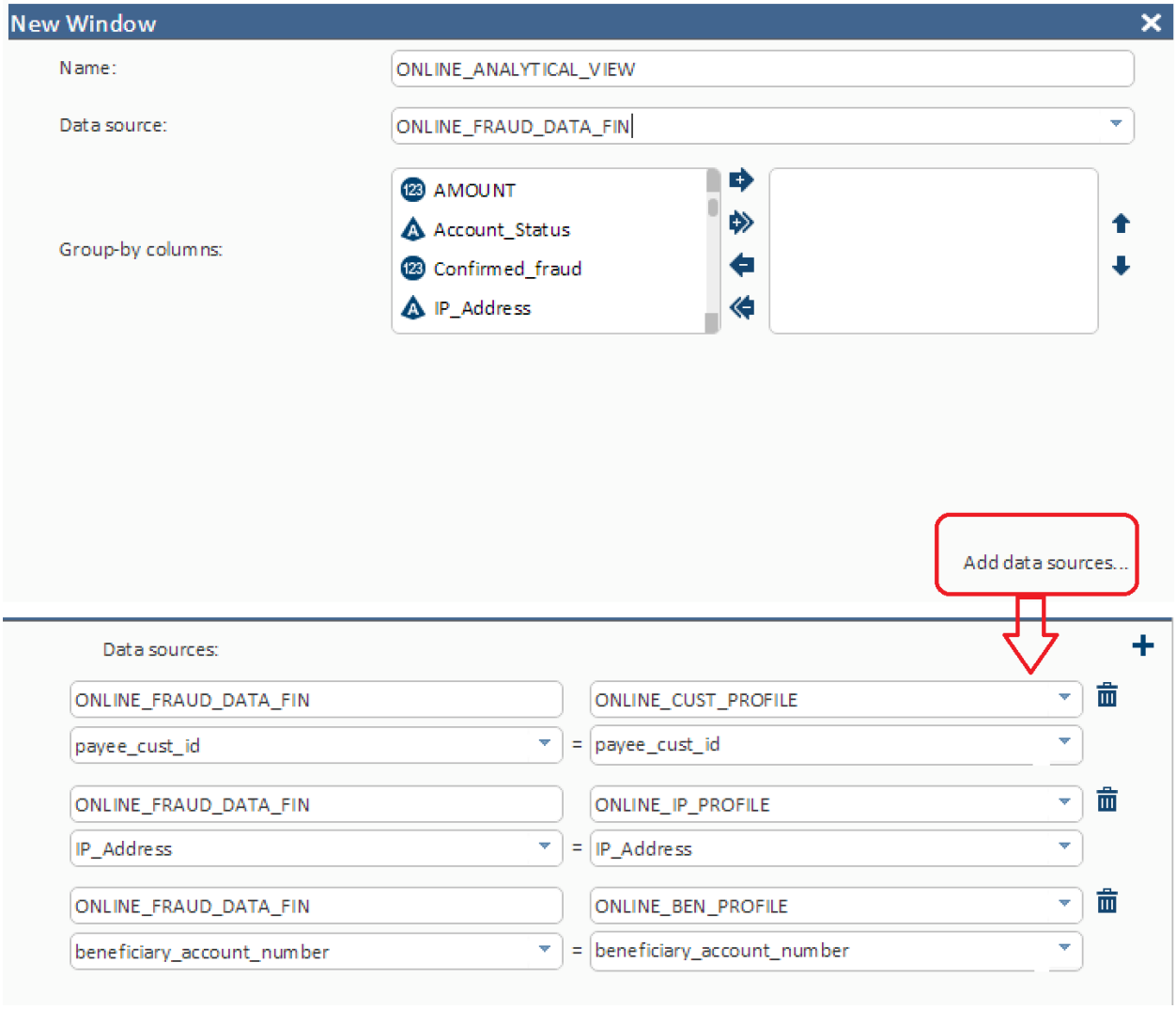
Column	Metric	Conditions
BEN_TOTAL_TRANSACTIONS	Count	None
BEN_INTERNATIONAL_TRANSACTIONS	Count	TRANSACTION_ORIGN="INTERNATIONAL"
BEN_FRAUD_TRANSACTIONS	Count	CONFIRMED_FRAUD="1"
BEN_TOTAL_TXN_AMT	Sum of AMOUNT	None
BEN_TXN_AV_AMT	Average of AMOUNT	None

Table 5. Example Beneficiary Profile Columns

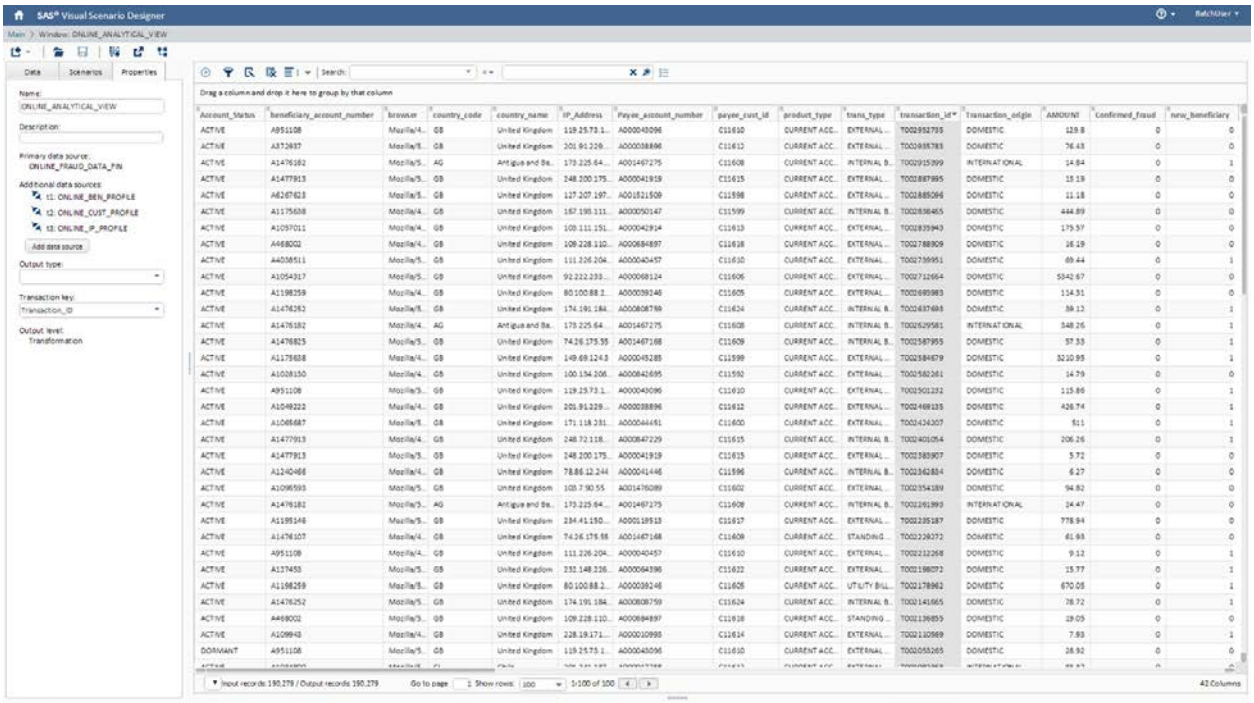


Display 6. Beneficiary Profile Window

Finally, create a transformation window that joins the three profile windows you created with the original transactional data as illustrated in Displays 7-8



Display 7. Create a Combined Window



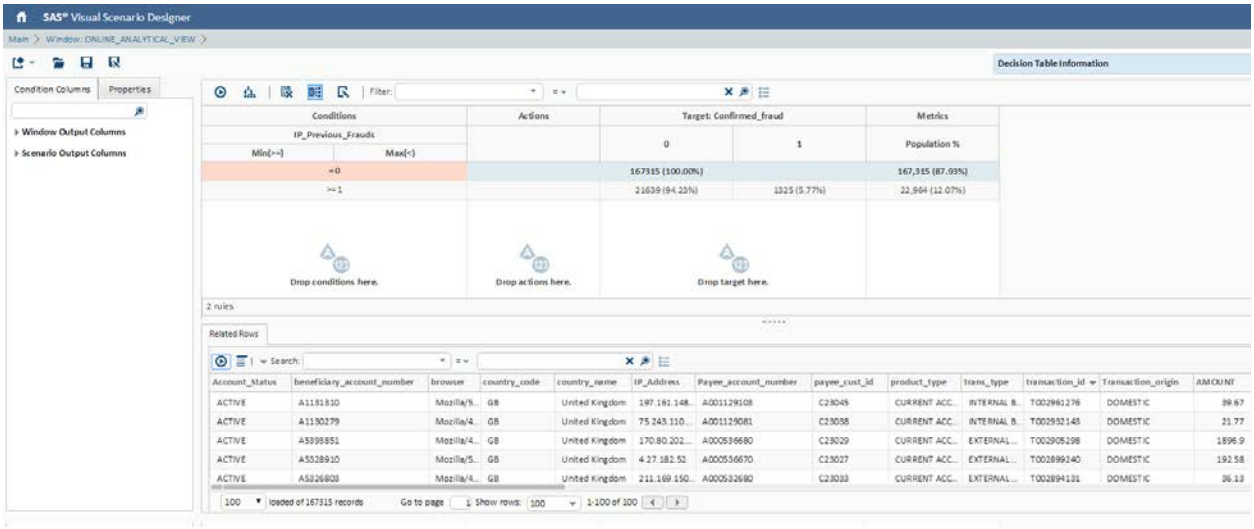
Display 8. Analytical View Window

USING A DECISION TABLE

SAS Visual Scenario Designer comes with powerful scenario authoring techniques that enables you to explore thresholds for combinations of conditions and actions. Decision tables enable you to model complicated business logic that involve a variety of conditions and their interrelationships. Each row in the table defines a single rule. Each column within a row defines the conditions or actions (decisions) of the rule. If a condition is met, the assigned action is performed.

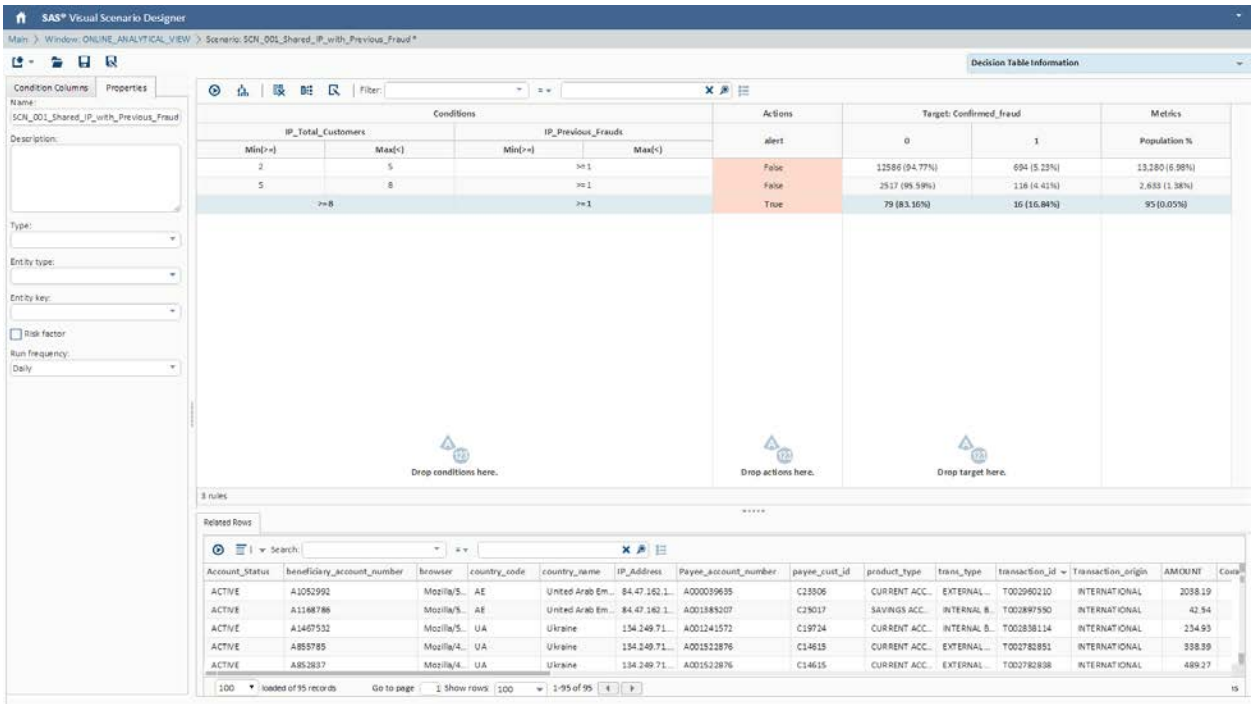
We illustrate how you can use the decision table functionality to create rules based on an understanding of how certain metrics have historically impacted fraud.

From the Online Analytical View window, create a new decision table scenario, and then move IP_PREVIOUS_FRAUD column from the Window Output Columns list to the Conditions column in the work area. Next, move the CONFIRMED_FRAUD column from the Window Output Columns list to the Target column in the work area. Now, you can see the impact of previously identified fraudulent transaction, with the same IP address, on future fraud.



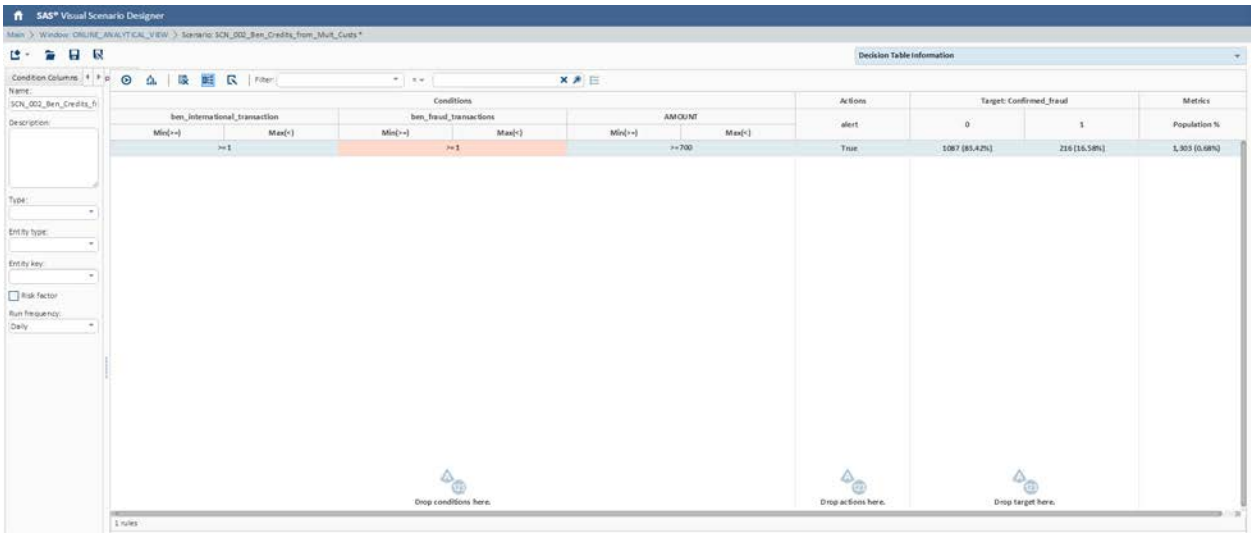
Display 9. Impact of IP Previous Fraud

Changing the condition value for the IP_PREVIOUS_FRAUD allows you to find the appropriate threshold. Add the IP_TOTAL_CUSTOMERS to the decision table to test the interaction between both the two columns and their impact on fraud. Adding an action variable such as ALERT completes the process of creating a scenario.



Display 10. Create IP-Related Fraud Scenario

Repeat the same process creating a scenario with BEN_INTERNATIONAL_TRANSACTIONS and BEN_FRAUD_TRANSACTIONS as conditions columns.

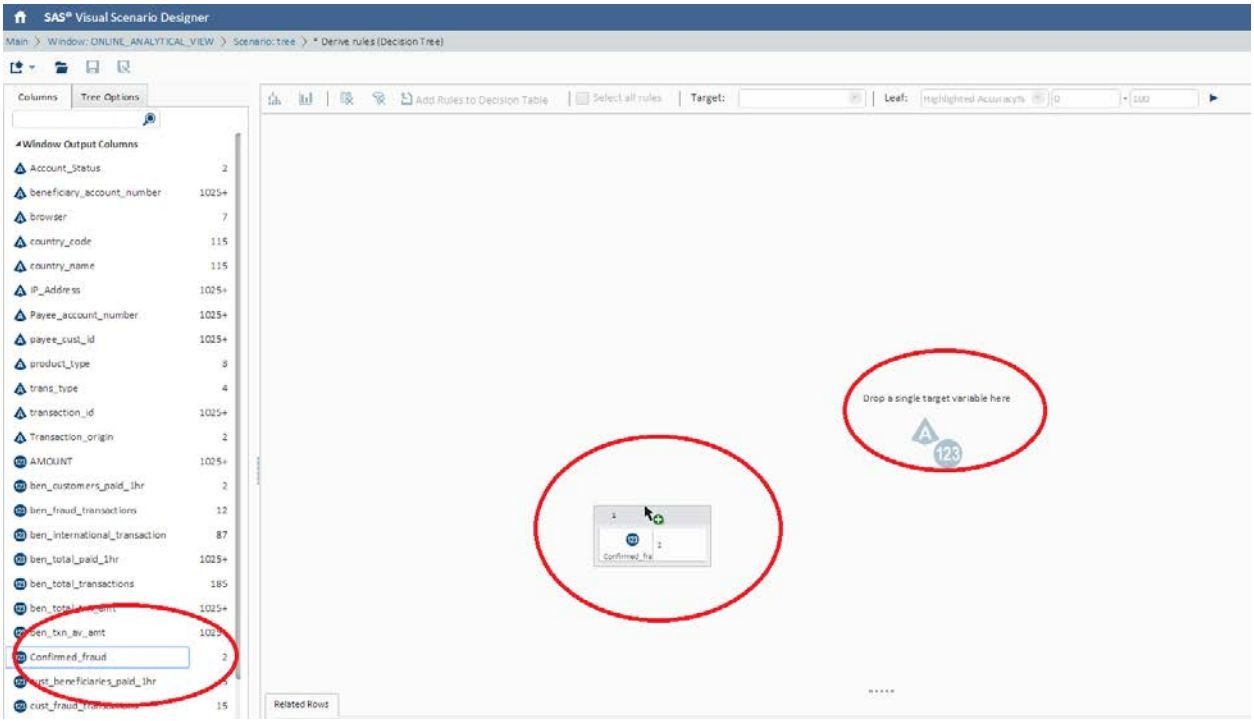


Display 11. Create International Beneficiaries Scenario

USING A DECISION TREE

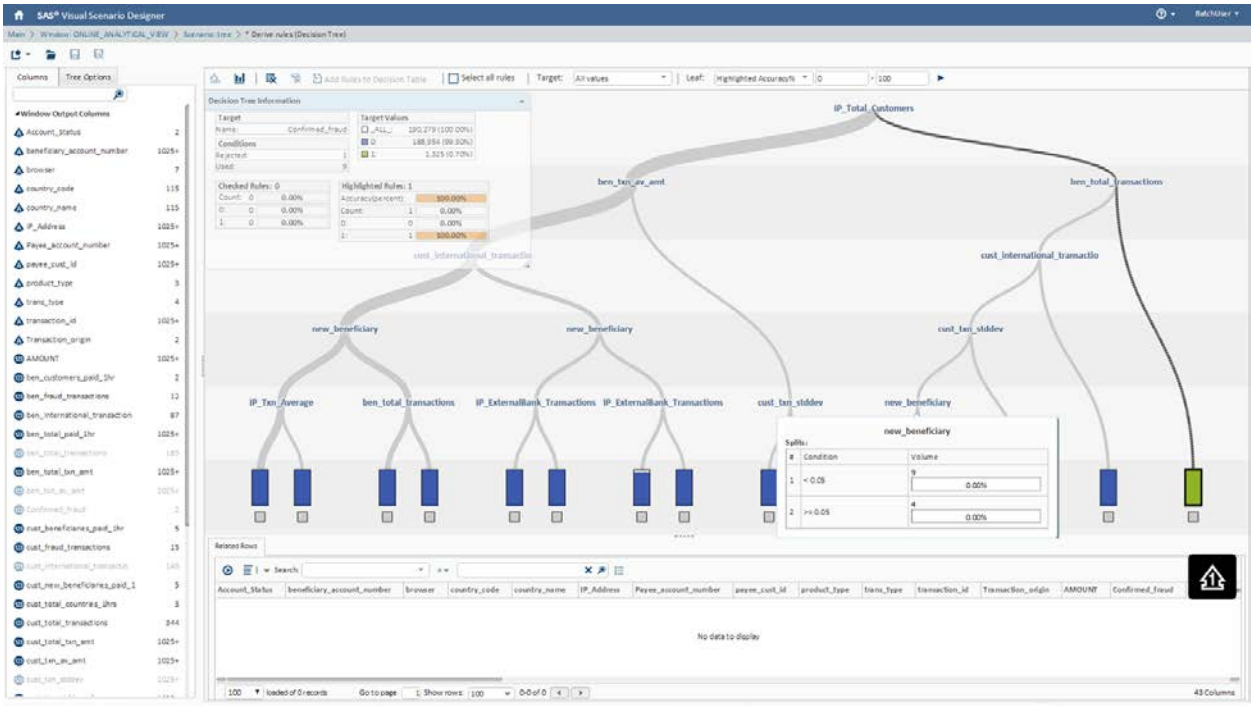
SAS Visual Scenario Designer has a built-in decision tree capability that enables you to use a target variable to produce rules that can be imported into a scenario. The purpose of a decision tree is to evaluate the overall effectiveness of any set of conditions in predicting a certain outcome.

From the Online Analytical View window, create a new decision table scenario, and then click the Decision Tree icon to get an empty work area. Select the CONFIRMED_FRAUD column as target variable.



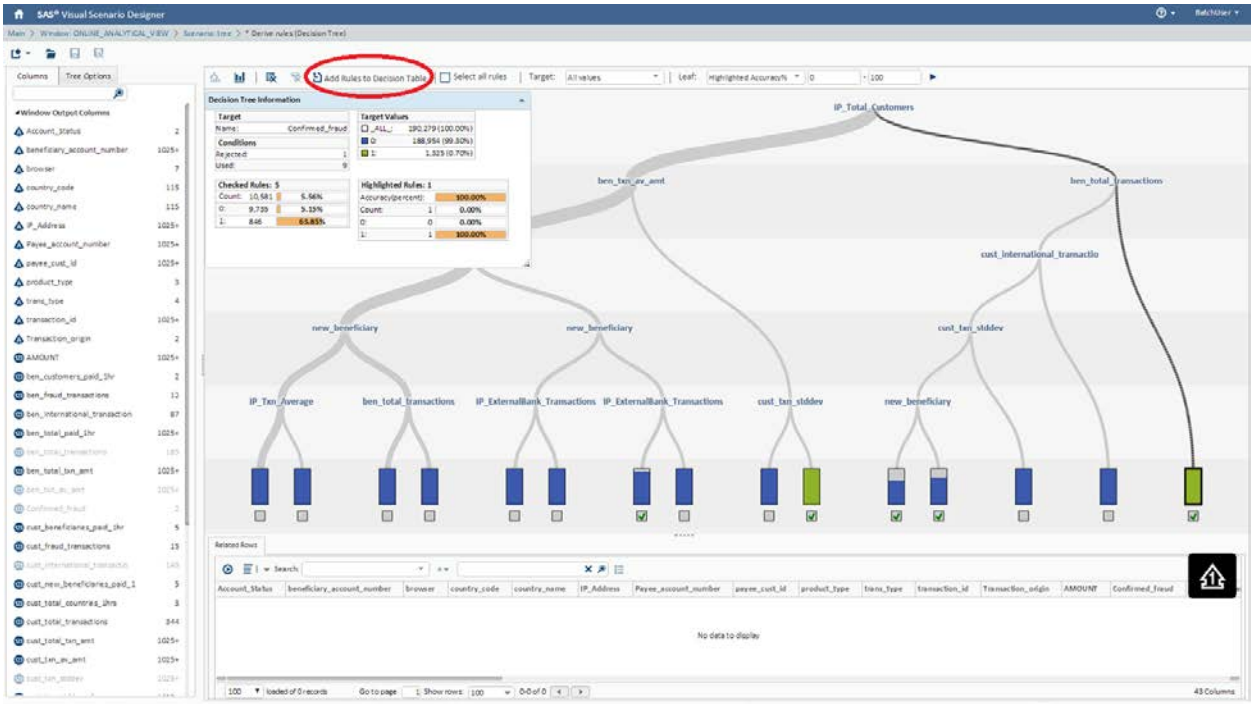
Display 12. Create New Decision Tree

Move the columns that might be useful in determining fraud from the Window Output Columns list on the Columns tab into the work area. These are your predictor columns. As you move columns into the work area, your tree is built based on the columns that have the biggest impact on fraud. If a predictor column does not contribute to the predictive accuracy of the tree, then it does not appear in the tree.



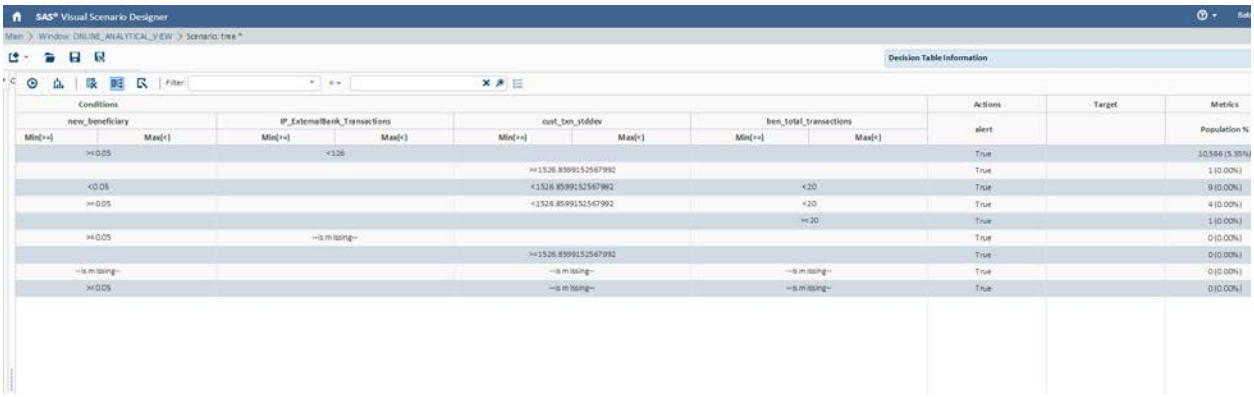
Display 13. Add Columns

Decide which rules you want to add to your decision table by clicking on the check box below each applicable leaf node. Next, add these rules to the Decision Table as illustrated in Display 14.



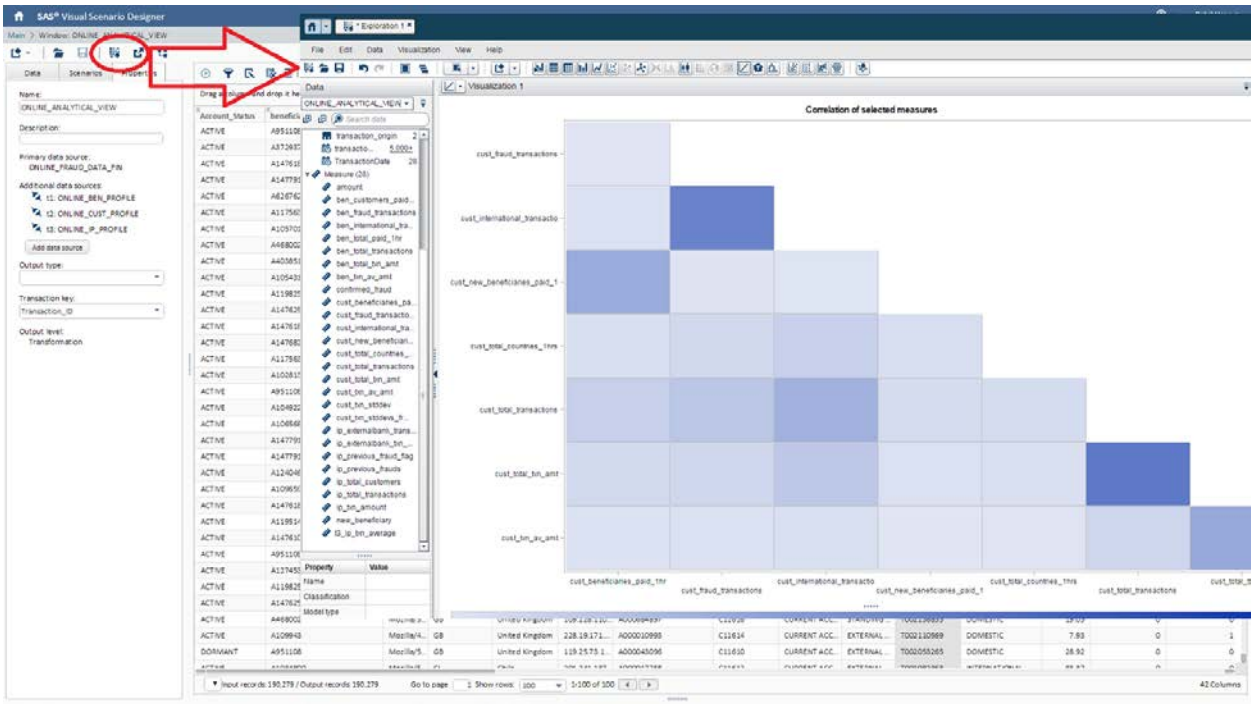
Display 14. Select Branches

Now you have a decision tree built scenario and you can add ALERT as an action variable.



Display 15. Create a Scenario

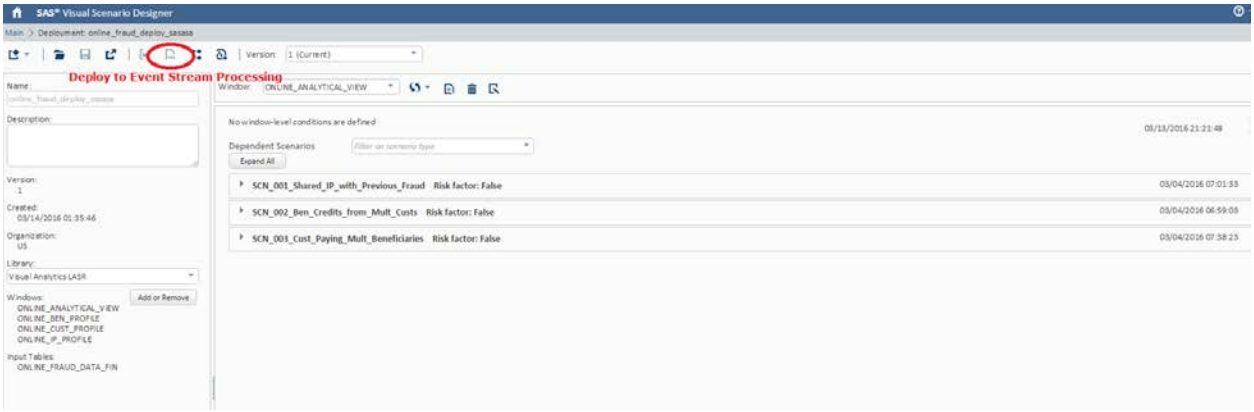
You can use SAS® Visual Analytics and SAS® Visual Statistics to create new scenarios. Launch SAS Visual Analytics Explorer from the Online Analytical View window, and then use SAS Visual Statistics, as shown in Display 16.



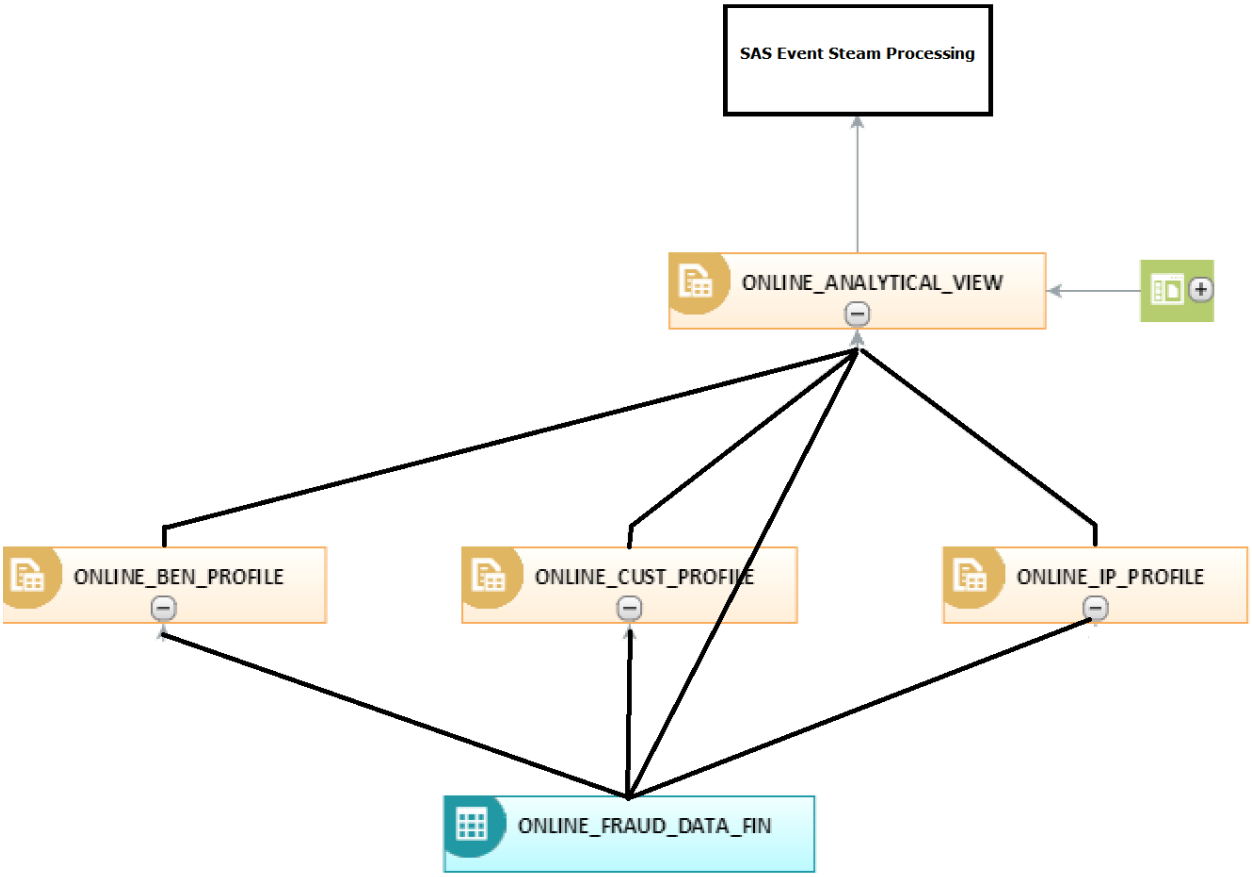
Display 16. Visual Analytics Explorer

SAS EVENT STREAM PROCESSING

SAS Event Stream Processing enables you to process and analyze a large number of continuously flowing events. Event stream processing engines can be embedded within new or existing applications to perform real-time analytics on streams of data continually as it's received. It is designed for extremely high-volume throughput and very low latency. SAS Visual Scenario Designer can deploy directly into a running SAS Event Stream Processing engine, allowing you to instantly use the profiling and aggregation, as well as rules and models, immediately in your online processing stream.



Display 17. Deploy into SAS Event Stream Processing



Display 18. SAS Visual Scenario Designer Online Fraud Flow

CONCLUSION

In this paper, we have outlined the difficulties of combating online fraud and identified techniques to empower you to structure data, detect anomalies, test hypothesis, and use sophisticated analytics to create scenarios in SAS Visual Scenario Designer, and the use them in online processing using SAS Event Stream Processing.

ACKNOWLEDGMENTS

SAS Visual Scenario Designer is the result of collaboration between developers, testers, and product managers. The authors wish to thank everyone involved in this effort.

RECOMMENDED READING

- *SAS Event Stream Processing: User's Guide*
- *SAS Visual Scenario Designer: User's Guide*

CONTACT INFORMATION

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