
Is Artificial intelligence our destiny? Data-driven Decision-making in a Dynamic Landscape using SAS Viya

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Author's Bio

Aman Bahl is an Associate Director, Statistical Programming with Syneos Health, and has over 18 years of Technology and Data services experience including 15 years of Clinical industry experience in the areas of project management, team management, statistical programming and other statistical services. Aman enjoys outdoor sports, trekking, travelling and volunteering.

Hrideep Antony is a Principal Statistical Programmer with Syneos Health, and has over 14 years of extensive SAS experience. Hrideep enjoys developing and providing innovative/efficacious solutions to streamline the FDA submission process. He has been given opportunities to present at multiple SAS conferences in the past. Hrideep enjoys spirituality, music, travelling, volunteering at nursing homes/rehabilitation facilities, learning and sharing knowledge.

Agenda

- ❖ Introduction
- ❖ SAS Viya and AI Capabilities
- ❖ SAS Viya – SAS Visual Data Mining and Machine Learning
- ❖ SAS Viya vs SAS version 9.4
- ❖ Few ways in which AI is changing Healthcare
- ❖ Implementing AI in Healthcare
- ❖ Conclusion

Introduction

As noted by computer scientist Kai-Fu Lee, *Artificial intelligence (AI) is going to change the world more than anything in the history of mankind. More than electricity* (Reference[1])

Apart from SAS Viya role we will also briefly cover following:

- ❖ Why to have medications that are only for the general population, when it can be customized for each individual?
- ❖ Why is AI adoption in healthcare important ?
- ❖ How will providers and patients benefit from the impact of AI-Driven tools ?
- ❖ What are current challenges of AI implementations ?

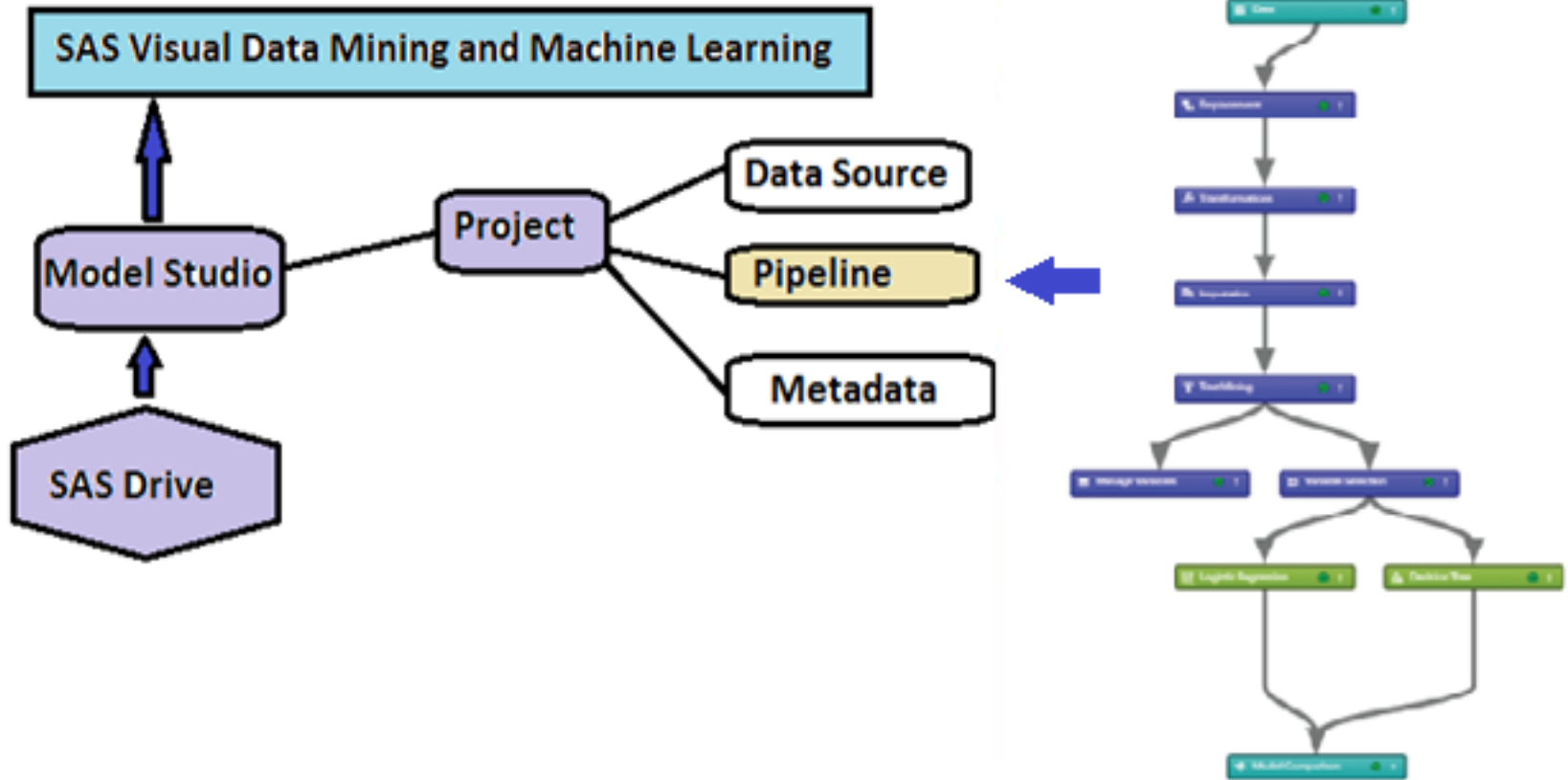
[1] <https://www.cbsnews.com/news/60-minutes-ai-facial-and-emotional-recognition-how-one-man-is-advancing-artificial-intelligence/>

SAS Viya and AI Capabilities



Assume you have data flying all around you. How can you connect it all ?

SAS Viya and AI Capabilities



SAS Viya and AI Capabilities

SAS Viya adds layers of interpretability and transparency to open the 'black box' of artificial intelligence.

❖ **Transparency of AI-generated decisions**

SAS Viya now features advanced analytics with built-in frameworks such as Partial Dependence (PD) , Local Interpretable Model-agnostic Explanation (LIME) and Individual Conditional Expectation (ICE).

❖ **Better data privacy**

SAS Viya automates identification and management of personal information (PI) such as age, address and financial information.

❖ **Integration of open source methods**

New capabilities in SAS Viya give users the ability to integrate Python, R and SAS models into SAS Viya.

SAS Viya and AI Capabilities

Some of the advantages are as follows:

- ❖ Attractive and user-friendly interface
- ❖ Complex analytical problems solved much faster
- ❖ Greater simplicity and improved usability
- ❖ Leverage machine learning to make the right decision after exploring multiple options
- ❖ Automatic hyperparameter tuning Feature in SAS Viya
- ❖ Automated assessment visualizations of the predictive models
- ❖ Instant choice of the best model in your project.
- ❖ Collaboration in one place

SAS Viya – SAS Drive

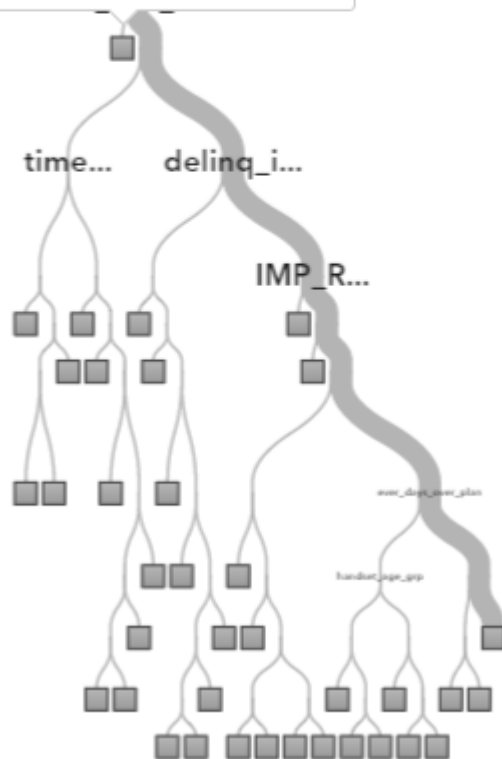
The screenshot displays the SAS Drive web interface. At the top, a dark blue header bar contains the text "SAS® Drive - Organize and Share Content" and a "New" button with a dropdown arrow. Below the header is a horizontal navigation bar with tabs: "All", "Recent", "Projects", "View Reports", "Prepare Data", "Build Models", "Manage Models", and "Build Graphs". On the left side, there is a sidebar with a search icon and a list of items: "My Favorites", "My Folder" (highlighted), "SAS Content", and "Recycle Bin". The main content area shows "My Folder" with two thumbnails. A context menu is open over the first thumbnail, listing the following options: "SAS Drive", "View Reports", "Actions", "Manage Data", "Prepare Data", "Explore and Visualize Data", "Build Models", "Manage Models", "Explore Lineage", "Build Graphs", "Manage Workflows", "Administration", and "Manage Environment". The background interface is dimmed.

SAS Viya – Model Studio

The image is a screenshot of the Microsoft Azure Machine Learning Studio interface. At the top, the title bar reads "Model Studio - Build Models". Below the title bar, there is a search bar and several icons. The main interface is divided into three tabs: "Data", "Pipelines", and "Pipeline Comparison". The "Pipelines" tab is currently selected. Under this tab, there are two sub-tabs: "Pipeline 1" and "Starter template". The "Pipeline 1" sub-tab is active, displaying a visual representation of a machine learning pipeline. The pipeline starts with a "Train" node, followed by a "Hyperparameter Tuning" node, then a "Cross Validation" node, and finally a "Scoring" node. The "Scoring" node is highlighted, and a context menu is open over it. The context menu contains the following options: "Add below", "Insert above", "Delete", "Download Score Code", "Rename...", "Save as...", "Add challenger model", "Run", "Results", and "Log". To the right of the pipeline view, there is a panel titled "Decision Tree". This panel contains a description of the model: "Fits a classification tree for a class target or a regression tree for an interval target." Below the description, there are two expandable sections: "Splitting Options" and "Pruning Options". At the bottom of the "Decision Tree" panel, there is a "Seed:" label followed by a text input field containing the value "12,345".

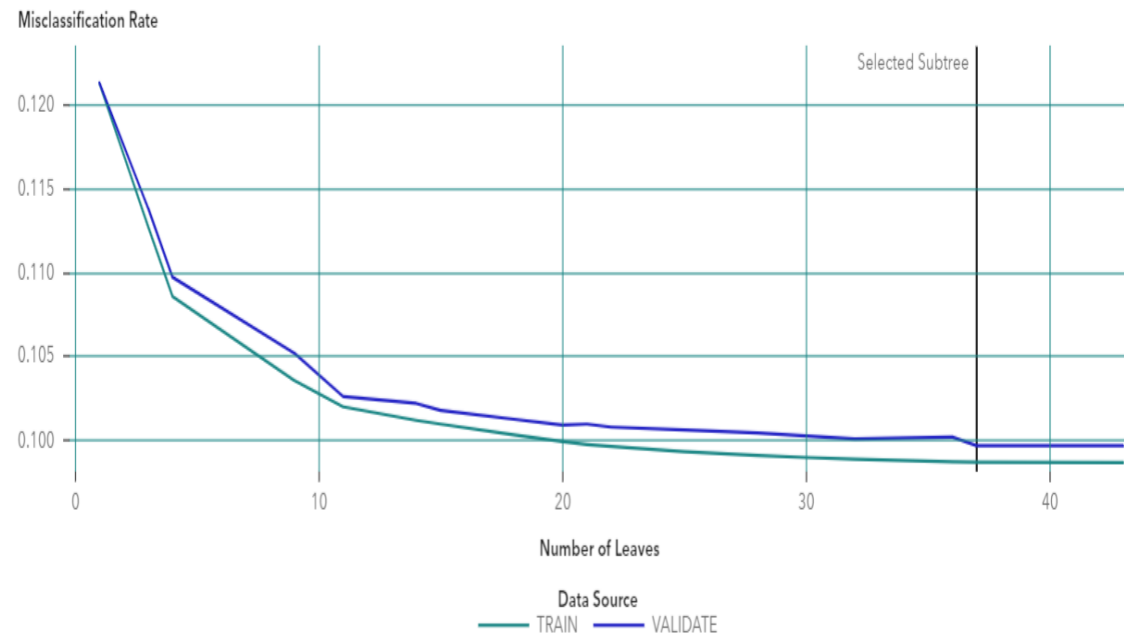
SAS Viya – Model Studio (Summary : Node Tab)

Node ID: 1
Predicted Value: 1
1: 100.00%
0: 0.00%
Count: 14



Tree Diagram

Pruning Error Plot



SAS Viya – Model Studio (Summary: Node tab)

Node Score Code



```
1 length _strfmt_ $12; drop _strfmt_;
2 _strfmt_ = ' ';
3
4 array _tleivname_78383299_{2} $2 _temporary_ ( ' 1'
5 ' 0');
6
7 array _dt_fi_78383299_{2} _temporary_;
8
9 _node_id_ = 0;
10 _new_id_ = -1;
11 nextnode_78383299:
12 if _node_id_ eq 0 then do;
13     _numval_ = LOG_MB_DATA_USG_M06;
14     if missing(_numval_) then do;
15         _numval_ = -1.7976931348623E308;
16     end;
17     if (_numval_ ge 9.78322123330518 and _numval_ lt 10.2981276140054) then do;
18         .
19     end;
20
```

Train Code



```
1 * -----*;
2 * Macro Variables for input, output data and files;
3 %let dm_datalib =;
4 %let dm_lib = WORK;
5 %let dm_folder = %sysfunc(pathname(work));
6 * -----*;
7 * -----*;
8 * Training for tree;
9 * -----*;
10 * -----*;
11 * Initializing Variable Macros;
12 * -----*;
13 ⊖ %macro dm_unary_input;
14 %mend dm_unary_input;
15 %global dm_num_unary_input;
16 %let dm_num_unary_input = 0;
17 ⊖ %macro dm_interval_input;
18 'avg_days_susp'n 'days_openwrkorders'n 'ever_days_over_plan'n
19 'days_susp'n 'days_openwrkorders'n 'ever_days_over_plan'n
20
```

SAS Viya – Model Studio (Summary: Node tab)

The SAS System

The TREESPLIT Procedure

Model Information	
Split Criterion	IGR
Pruning Method	Cost Complexity
Max Branches per Node	2
Max Tree Depth	10
Tree Depth Before Pruning	10
Tree Depth After Pruning	10
Number of Leaves Before Pruning	64
Number of Leaves After Pruning	37

	Training	Validation	Test	Total
Number of Observations Read	39590	16967	0	56557
Number of Observations Used	39590	16967	0	56557

The SAS System

The TREESPLIT Procedure

Fit Statistics for Selected Tree		
	Number of Leaves	Misclassification Rate
Training	37	0.0987
Validation	37	0.0997
Test	37	0.0000

Variable Importance				
Variable	Importance	Std Dev Importance	Relative Importance	Count
ever_days_over_plan	823.40	180.58	1.0000	5
delinq_indicator	310.75	138.26	0.3774	3
handset_age_grp	95.2168	28.8957	0.1156	4
times_susp	73.7630	9.5550	0.0896	4
avg_days_susp	61.5471	26.4594	0.0747	2
LOG_MB_DATA_USG_M06	52.7991	6.4718	0.0641	6
IMP_REP_MOU_ONNET_PCT_MOM	34.2435	9.0012	0.0416	3
wrk_orders	33.1413	9.1007	0.0402	3
pymts_late_ltd	9.8800	1.7202	0.0120	3

SAS Viya – Model Studio (Summary: Assessment tab)



After changing the maximum depth (from 10->14), minimum leaf size (5->15), number of interval bias (20->200), the decision tree node is run again. The performance can be checked by looking at the lift reports or ROC charts and fit statistics.

Fit Statistics

Data Role	Partition Ind...	Formatted P...	Sum of Freq...	Average Sq...	Divisor for A...	Root Averag...	Misclassifica...
TRAIN	1	1	39,590	0.0807	39,590	0.2840	0.0910
VALIDATE	0	0	16,967	0.0808	16,967	0.2843	0.0916

SAS Viya – SAS Visual Data Mining and Machine Learning

Supervised Learning

REGSELECT	Ordinary least squares models
LOGSELECT	Logistic regression models
GENSELECT	Generalized linear models
NLMOD	Nonlinear regression models
PLSMOD	Partial least square models
QTRSELECT	Quantile regression models
TREESPLIT	Decision tree models
FOREST	Random forest models
GRADBOOST	Gradient boosting models
NNET	Neural network models
SVMACHINE	Support vector machine models

Unsupervised Learning

KCLUS	k-means & k-modes clustering
PCA	Principal component analysis
SVDD	Support Vector Data Description
RPCA	Robust PCA
MWPCA	Moving Windows PCA

SAS Viya vs SAS version 9.4

Analysis	SAS ver 9	SAS VIYA
Regression Modeling	proc reg proc glmselect	proc regselect
Unsupervised Segmentation	proc stdize proc fastclus	proc kclus
Logistic Regression Modeling	proc logistic	proc logselect
Principal Component Analysis	proc princomp	proc pca
Unsupervised Variable Reduction	proc varclus	proc varreduce
Generalized Linear Models	proc genmod	proc genselect
Autotuning : Decision tree		proc treesplit
Autotuning : Neural networks		proc nnet
Ensemble Methods: Gradient Boosting		proc gradboost
Factorization Machines		proc cardinality proc factmac
Community Detection		proc network

Few ways in which AI is changing Healthcare

Reasons for AI Adoption in Healthcare

- ❖ Increase in digital data and difficulties in handling large amount of patients' data
- ❖ Increase in number of diseases, early diagnosis and efficient treatment options
- ❖ Reduction in the costs and improvement in efficiency by treating larger number of patients.

Few ways in which AI is changing Healthcare

- ❖ Precision Medicine
- ❖ Personal Health Virtual Assistant
- ❖ Improving Quality Of Sleep
- ❖ Medical Imaging Analysis
- ❖ Healthcare Bots

Many of the answers lie in the vast amount of medical data already collected.

For example, around 25,000 people in the US are diagnosed with brain tumors every year.

Implementing AI in Healthcare:

Few Barriers for AI Adoption in healthcare:

- ✓ With the addition of new parameters in healthcare information such as images, audio and video, AI is desired to have context specific capability for decision making.
- ✓ Many healthcare organizations still lack an integrated platform. This is a challenge when establishing the building blocks for AI implementation.
- ✓ Another roadblocks for AI in healthcare is the low level of consistency among the records of healthcare providers resulting in inaccurate analysis of the captured data.

Here are few insights while implementing AI solutions in healthcare:

- ✓ Factor in extra time and cost for early adoption
- ✓ Reduce cost and complexity by leveraging open-source technologies and limiting customization.
- ✓ Carefully select the data used to “train” any AI/ML model
- ✓ Expected return on investment (ROI) should include the time period and time frame
- ✓ Build solutions for average transaction length and volumes but with capacity for longer transactions and peak volumes.

Conclusion

SAS Visual Data Mining and Machine Learning enables you to build complex analytics pipelines to determine the best model for your data.

As the AI market continues to evolve and new best practices are established, there are challenges and unique considerations for the successful technology adoption.

Great power comes with great responsibility.

Health is not something that happens a couple of times a year when you visit doctors. Health is something that happens every day. It is happening right now. It is cumulative of choices, lifestyles we make every minute.

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Helpful SAS Viya Resources

SAS® Viya Enablement

<https://support.sas.com/edu/schedules.html?crs=EVIYAEN&source=aem&ctry=US>

SAS® Visual Data Mining and Machine Learning

<https://support.sas.com/en/software/visual-data-mining-and-machine-learning-support.html>

Also following free SAS® Viya ebooks are available at SAS website:

- ✓ Exploring SAS® Viya®: Data Mining and Machine Learning
- ✓ Exploring SAS® Viya®: Programming and Data Management
- ✓ Exploring SAS® Viya®: Visual Analytics, Statistics, and Investigations

<https://support.sas.com/en/books/free-books-viya.html>

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