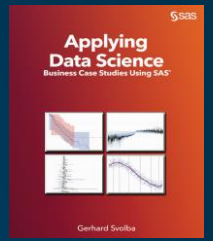
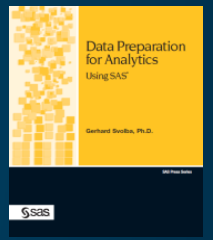
# Wie bringe ich 4 unterschiedliche Analytik-Benutzergruppen an einen Tisch? – Die Offenheit von SAS Viya ermöglicht eine Analyseplattform für unterschiedliche Benutzertypen

Gerhard Svolba, SAS Austria

Mannheim, 2. März 2018 - KSFE 2018





https://github.com/gerhard1050/



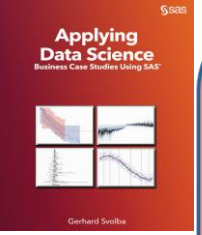
THE POWER TO KNOW.


SAS Club 2017


SAS Programmer,
25 years DATA; SET;RUN;

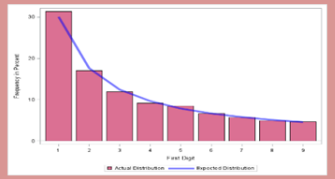
Python Guy with Converse Shoes

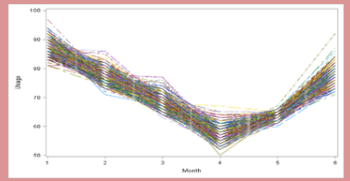
Point&Click Business User




## Checking the Alignment with Predefined Pattern

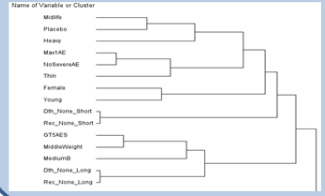
*Which customers show a behaviour which is far from what you expected?*

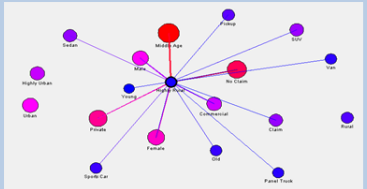



## Listen to Your Data – Discover Unknown Relationships

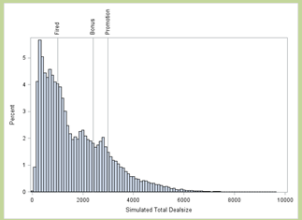
*Can your data tell you stories, even if you don't ask them?*

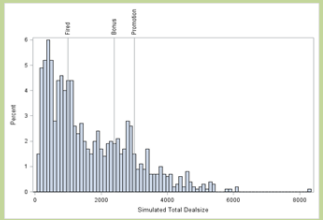



## Using Monte Carlo Simulations to Understand the Outcome Distribution

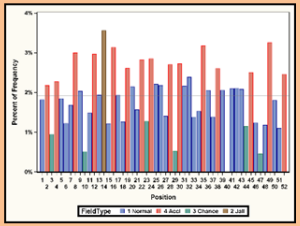
*Will the Sales Manager keep his job (when you look at his sales pipeline)?*

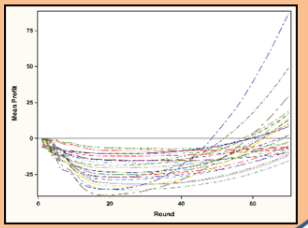



## Studying Complex Systems – Simulate the Monopoly® Board Game

*How can you simulate complex environments to get insight in the most frequent processes?*





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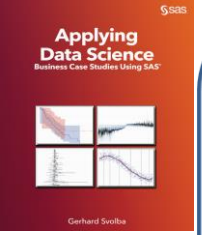
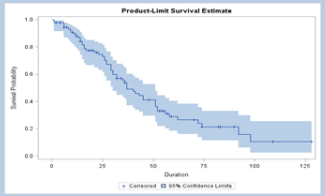
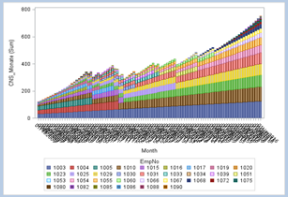



## Performing Headcount Survival Analysis for Employee Retention

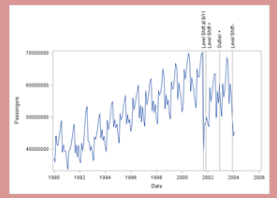
*Can you make assumptions about the average length of time intervals, even if most of the endpoints have not yet been observed?*

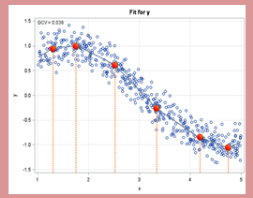



## Detecting Outliers and Structural Changes in Longitudinal Data

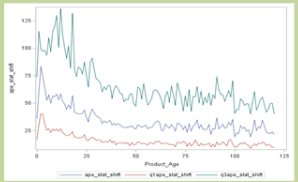
*Can you automatically detect events and changes in the course of your data over time?*

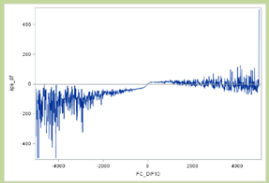



## Explaining Deviations and Forecast Errors

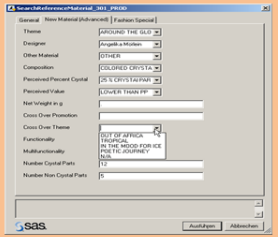
*Do the demand planners really improve forecast accuracy with their manual overwrites?*

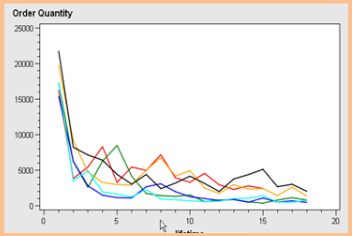


## Forecasting the Demand for New Products

*Can you assess the exptected demand of products that are introduced right now?*







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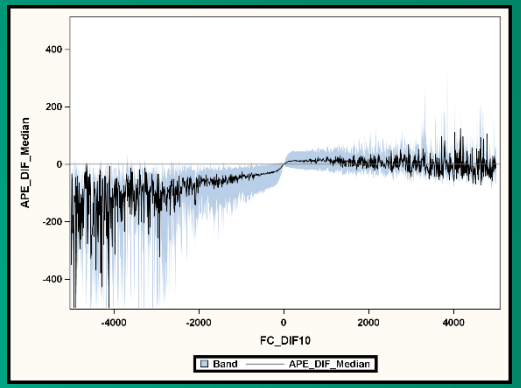
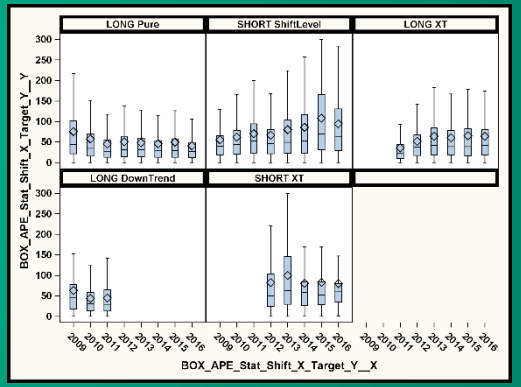
# Data Science in Action: #4

## Explaining Forecast Errors and Deviations




*Do the demand planners really improve forecast accuracy with their manual overwrites?*

Linear Regression
Quantile Regression
Descriptive Statistics

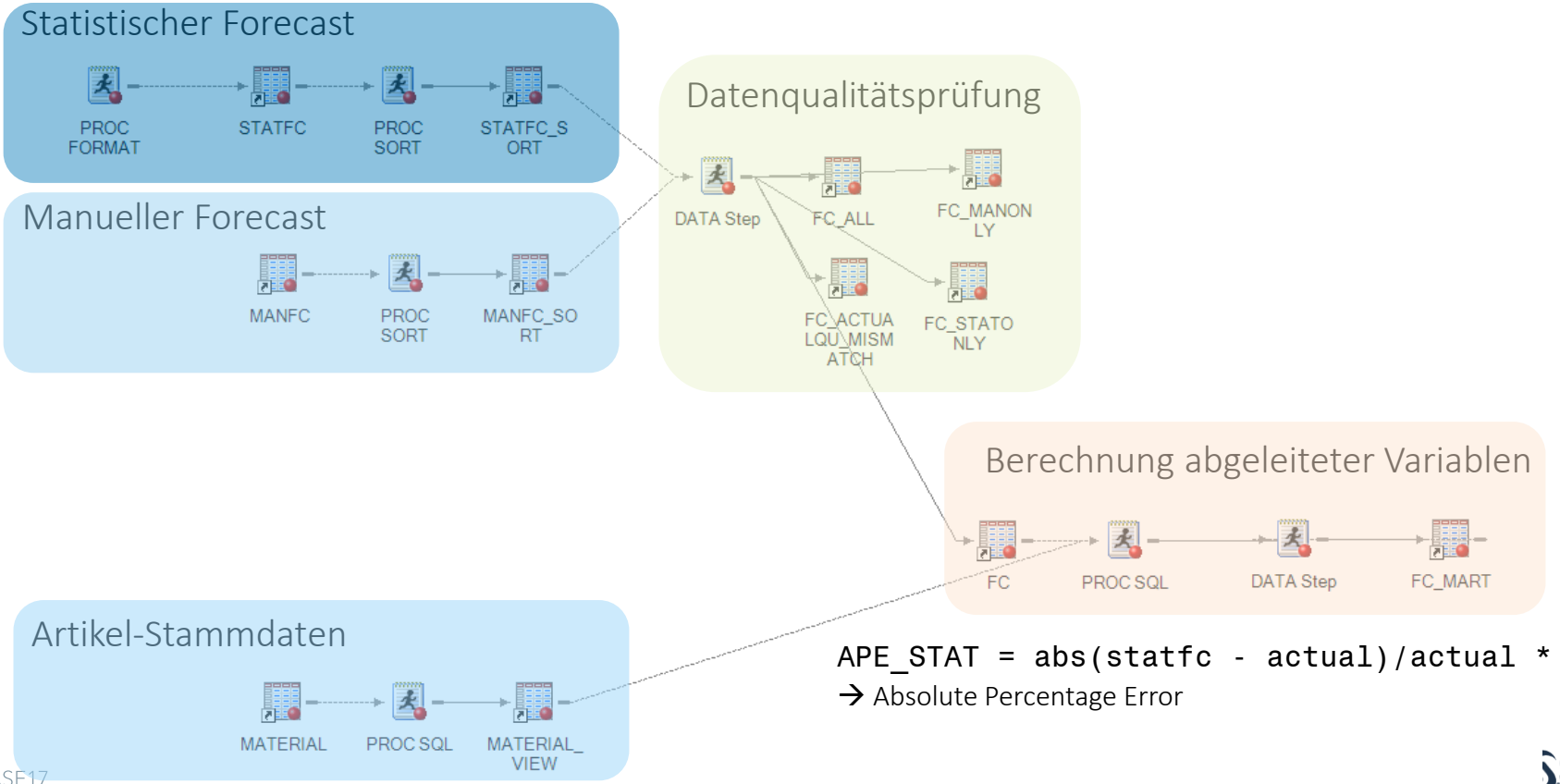
# „Was bisher geschah“ (1)

## Fachliche Fragestellung im Unternehmen

- Monatliche Nachfrage wird mittels Zeitreihenmodellen vorhergesagt.
- Produkte mit langer und kurzer Absatzhistorie (langjährige Artikel sowie Fashion)
- Analyse des Vorhersage-Fehlers
  - Welcher Vorhersage-Fehler wird von 50%, 75% meiner Vorhersagen nicht überschritten?
  - Welchen Faktoren führen zu geringen Vorhersagefehlern?
  - Gibt es zeitliche Trends und saisonale Muster im Vorhersagefehler?
- Faktoren
  - Stammdaten: PRODUCT_AGE, PRICE_INDEX, LAUNCH_MONTH, PRODUCT_GROUP
  - Stat. Forecasting: MODEL, LEAD_TIME, TARGET_YEAR, TARGET_CALENDAR_MONTH

# „Was bisher geschah“ (2)

## Datenaufbereitung




```
APE_STAT = abs(statfc - actual)/actual * 100
```

→ Absolute Percentage Error

# 4 different user roles analyse a business question


Gerhard Svolba
SAS Visual Analytics

Gernot Engel
SAS Studio Tasks

Franz Helmreich
SAS Studio Program

Matthias Svolba
Python
(Jupyter Notebook)

# Opening the SAS Analytic Platform via Different Interfaces

Start the SAS Cloud Analytic Server

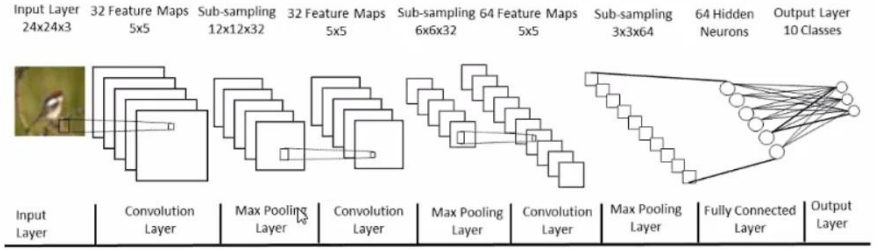
Load the DeepLearning Action Set

Use the CAS Random Forest

Display the Results in R-Studio

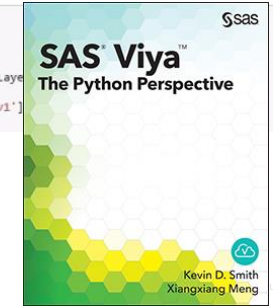
```
s = sw.CAS('cas01.unx.sas.com', 11775)
s.sessionprop.setsessopt(caslib='CASUSER',timeout=3.1536E7)
s.loadactionset('deepLearn')
```

**Define the Network Architecture**



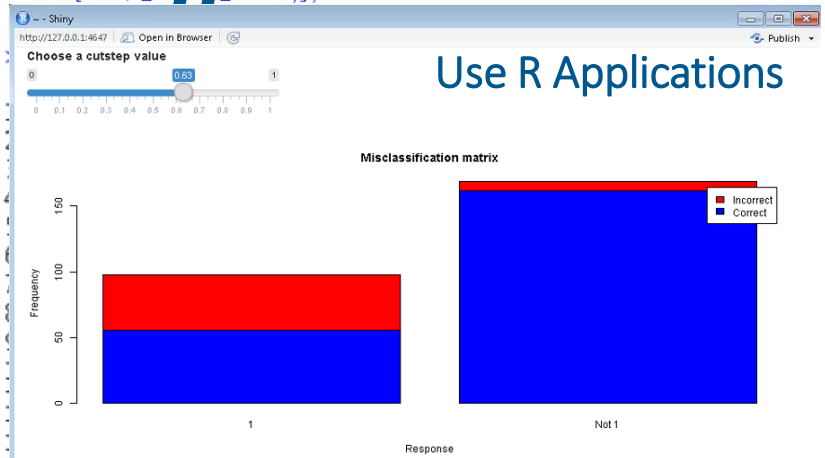

```
In [ ]: s.createmodel(model=dict(name='convNet',replace=True),type='CNN')
s.addLayer(model='convNet', name='data', type='input',
           inputOpts=dict(nchannels=3, width=24, height=24, scale=1))
s.addLayer(model='convNet', name='conv1', type='convolution',
           convOpts=dict(nFilters=32, width=5, height=5, stride=1, init='msra2'), srcLaye
s.addLayer(model='convNet', name='pool1', type='pooling',
           poolingOpts=dict(width=2, height=2, stride=2, pool='max'), srcLayers=['conv1']
s.addLayer(model='convNet', name='conv2', type='convolution',
```

Define the Network Layers




```
> dat1 = cas.read.csv(conn, file = "//sashq/root/u/sasyqi/titanic_train.csv",
+                     casOut = list(replace = TRUE))
NOTE: Cloud Analytic Services made the uploaded file available as table TITANIC_TRAIN in ca
slib CASUSER(sasyqi)
> rfout = cas.decisionTree.forestTrain(
+   dat2[dat2$`_PartInd_` == 1,],
```

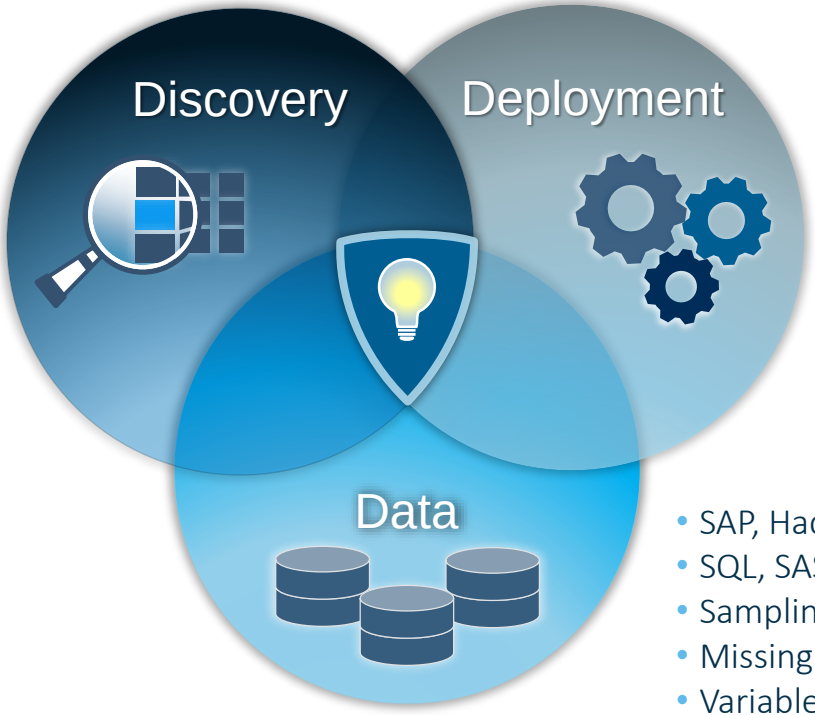
Use R Applications




```
[1] "The statistics values for cutoff 0.63 is"
  _Index_  _Column_ _Event_ _Cutoff_ _TP_ _FP_ _FN_ _TN_ _Sensitivity_ _Specificity_
```

# Data Mining und Machine Learning mit der SAS Analytic Plattform

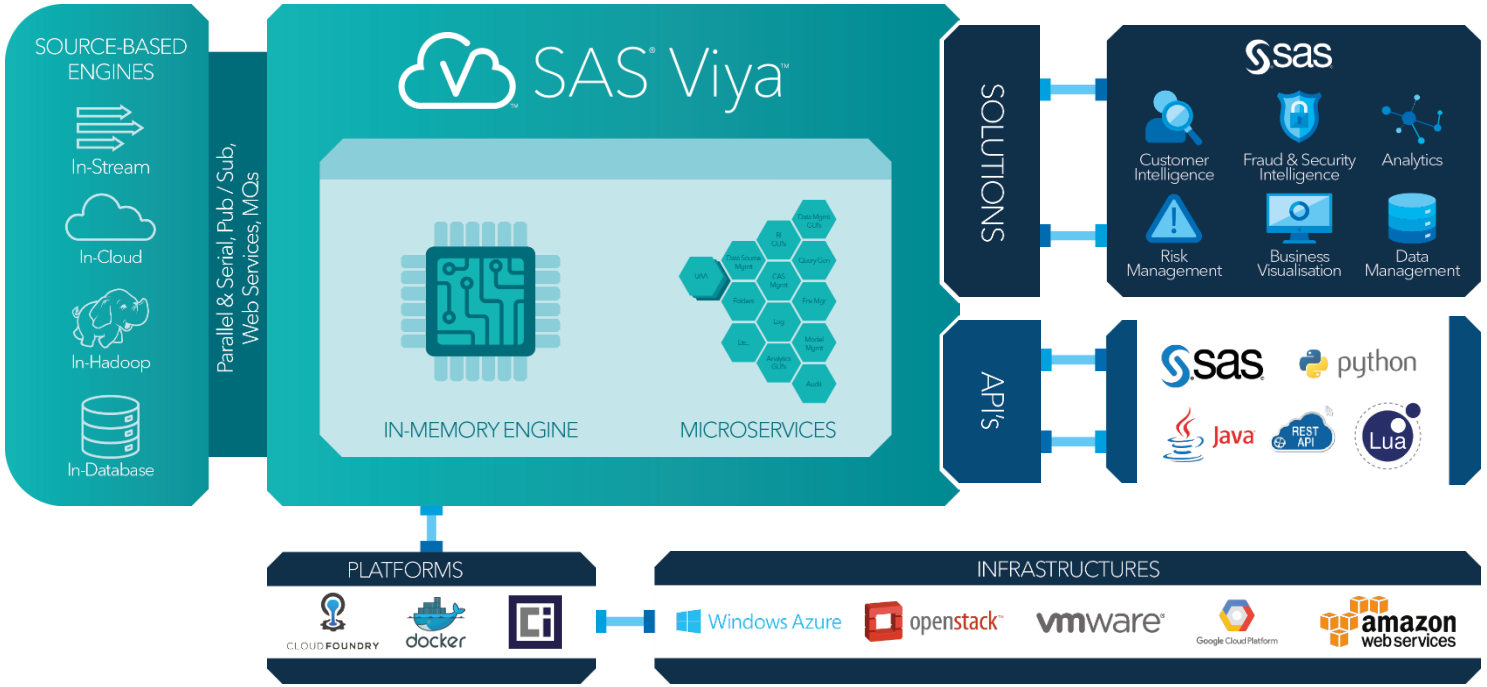
- Logistic Regression
- Linear Regression
- Generalized Linear Models
- Nonlinear Regression
- Ordinary Least Squares Regression
- Decision Trees
- Partial Least Squares Regression
- Quantile Regression
- K-means and K-modes Clustering
- Principal Component Analysis
- Random Forest
- Gradient Boosting
- Neural Networks
- Support Vector Machines
- Factorization Machines
- Network Analytics/Community Detection
- Text Mining
- Boolean Rules
- Auto-tuned Hyper-parameters




- Assess Supervised Models
- Modellverwaltung
- Deployment
- Laufende Validierung
- Modell-Retirement
- Retraining

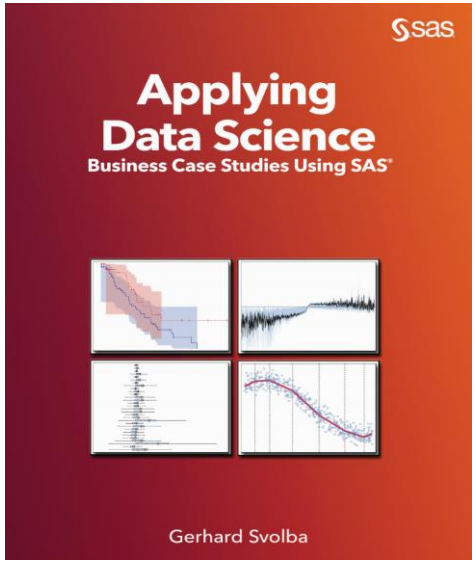
- SAP, Hadoop, Streaming, rel.DB, …
- SQL, SAS Datastep, Matrix
- Sampling and Partitioning
- Missing Value Imputation
- Variable Binning
- Variable Selection
- Transpose

# Überblick über die SAS Analytic Plattform



# More Information

Gerhard Svolba – Principal Analytic Solutions Architect
sastools.by.gerhard@gmx.net
https://github.com/gerhard1050/




- Applying Data Science – Business Case Studies Using SAS, SAS Press 2017
- Eight Case Studies showing how Data Science and Analytics can be applied to provide insight into yout data and improve your business decisions
- http://www.sascommunity.org/wiki/Applying_Data_Science_-_Business_Case_Studies_Using_SAS

# SAS Viya Technical Primer

Deep Learning Toolkit

Image Processing Toolkit

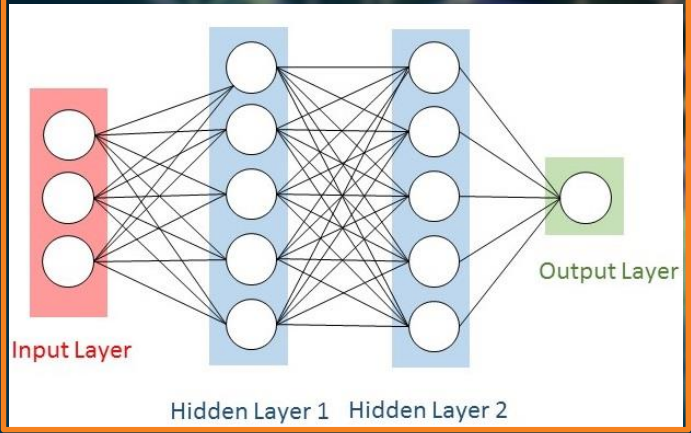
Natural Language Toolkit

# Deep Learning Toolkit

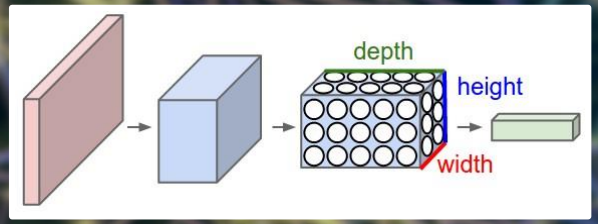
## Ships with VDMML license as CAS actions

CAS Action, but also built into MS pipeline for Neural Nets with more than 5 layers

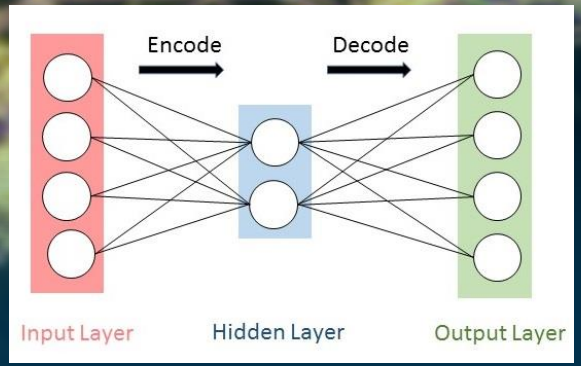
**DEEP FORWARD**



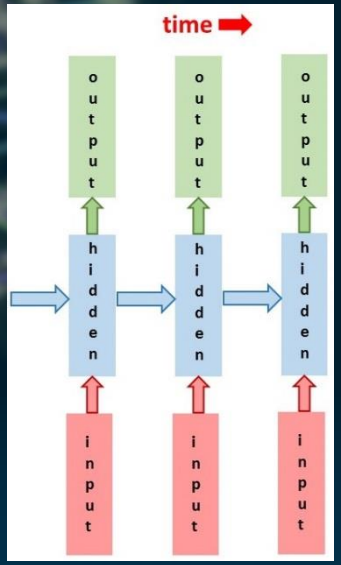

**CONVOLUTIONAL**




**AUTOENCODERS**




**RECURRENT**



# Image Processing Toolkit

## Ships with VDMML license as CAS actions


### Image Action Set (Image)

- **LoadImages** – loads images from a path
- **SaveImages**– writes images to a table
- **CompareImages** – compares two sets of images
- **ProcessImages** – performs core functions

### Biomedical Action Set (bioMedImage)

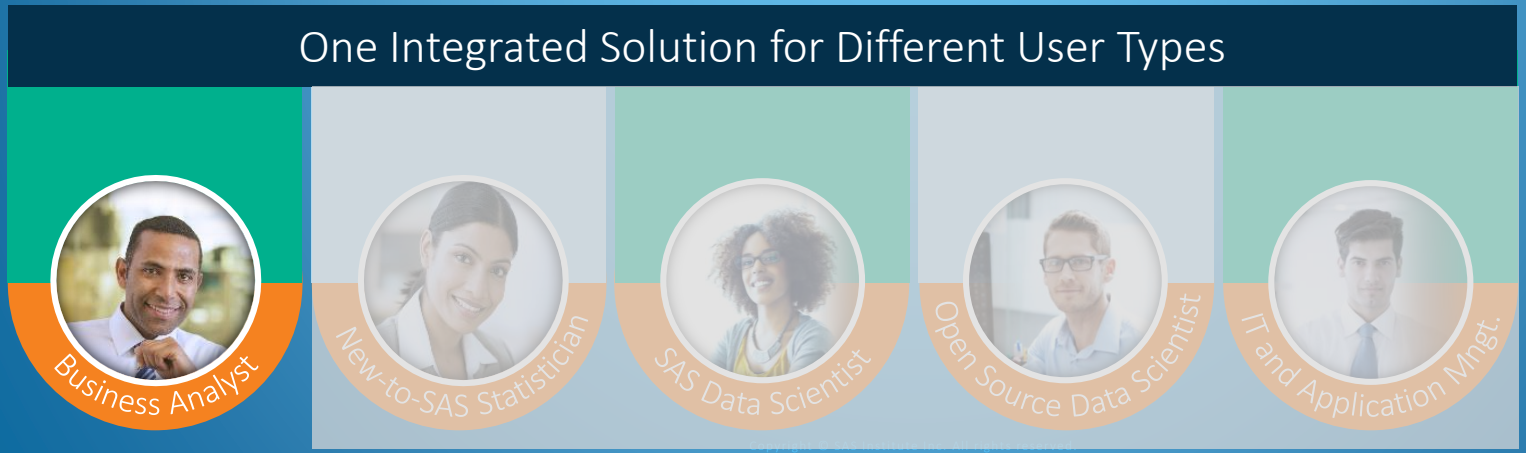
- **buildSurface** – This action can process an image table containing biomedical image data and generate 3D surfaces required to visualize the images.
- **Biomedical extensions to loadImages & saveImages** – Both of these actions are being extended to support loading and saving biomedical images (ex. DICOM images).

# Analyse der NBA 1997 Daten durch 4 verschiedene Benutzer-Rollen

## Offenheit der SAS Analytic Plattform für unterschiedliche Zugriffsarten

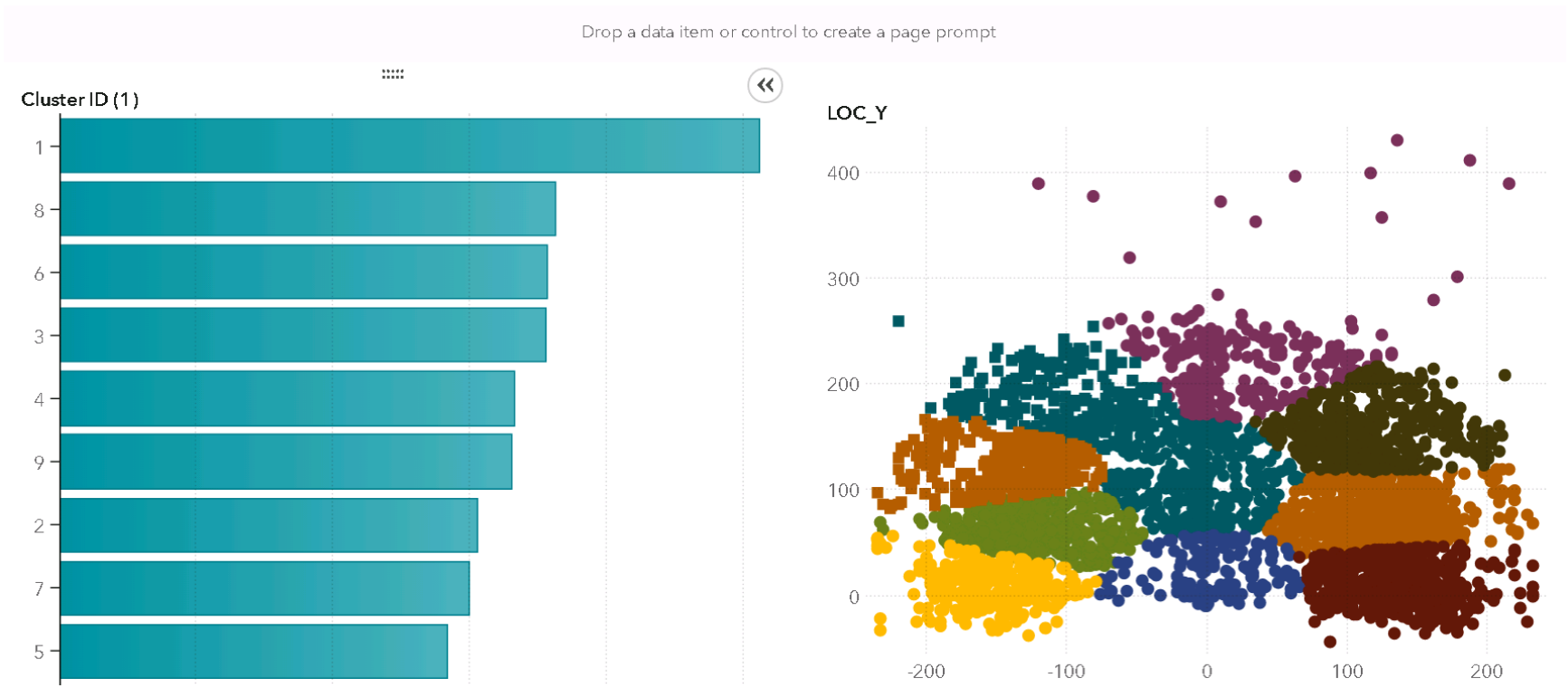
# Analyse der NBA 1997 Daten durch 4 verschiedene Benutzer-Rollen

SAS Visual Analytics und SAS Visual Statistics für den Business Analyst



# SAS Visual Statistics für den Business Analyst

## Point&Click Zugriff auf Machine Learning Methoden



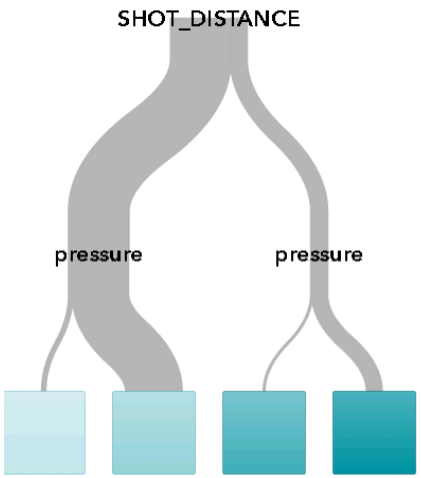
# SAS Visual Statistics für den Business Analyst

## Point&Click Zugriff auf Machine Learning Methoden

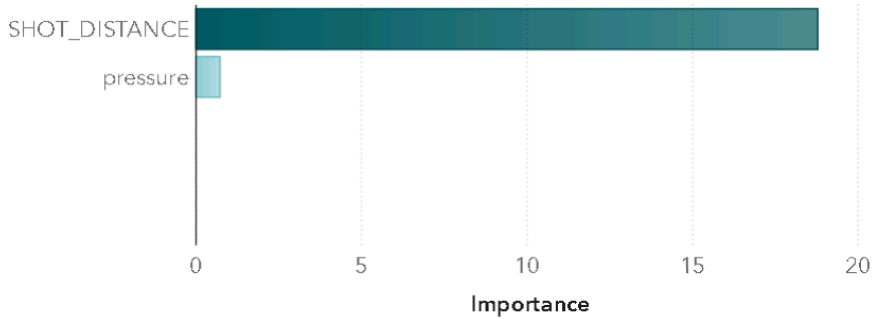
Drop a data item or control to create a page prompt

*Decision Tree* **SHOT_MADE_FLAG** ASE **0.245162** Observations Used **4,809**

Tree




Variable Importance



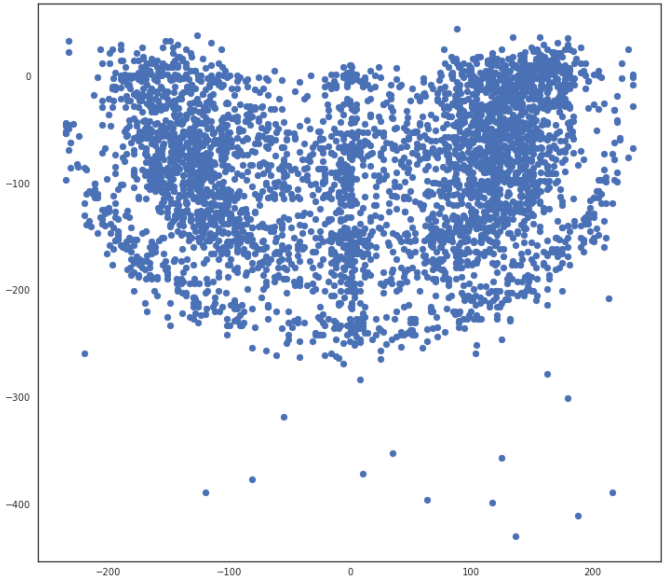

Assessment

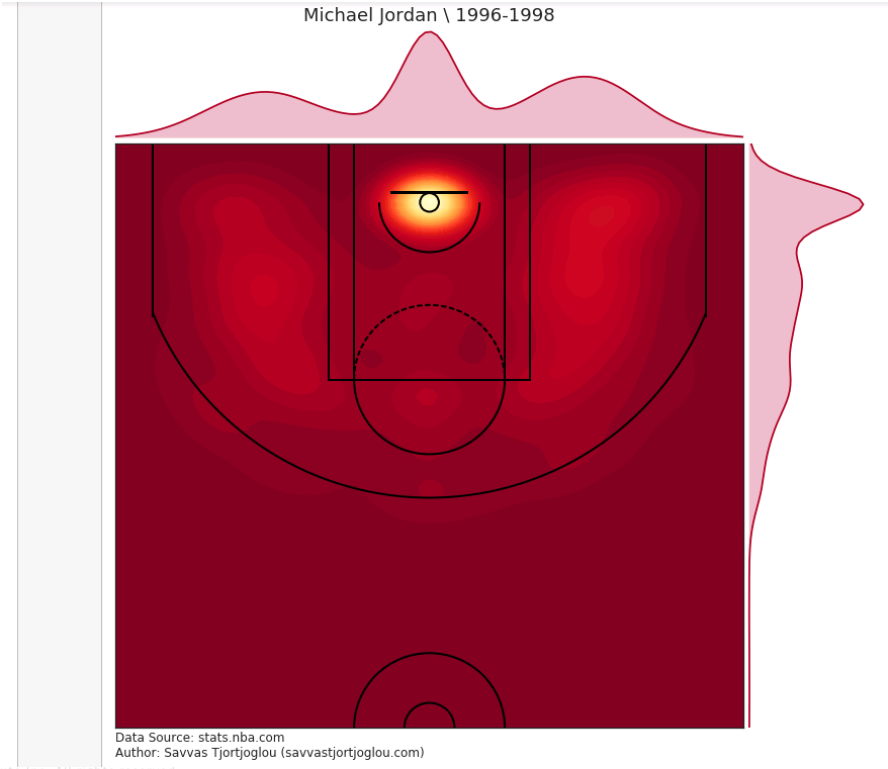
# Analyse der NBA 1997 Daten durch 4 verschiedene Benutzer-Rollen

## SAS-Python Integration für den Open Source Data Scientist

# How good was Jordan under pressure?

## Some Graphs benefiting from the open source community




http://savvastjortjoglou.com/nba-shot-sharts.html

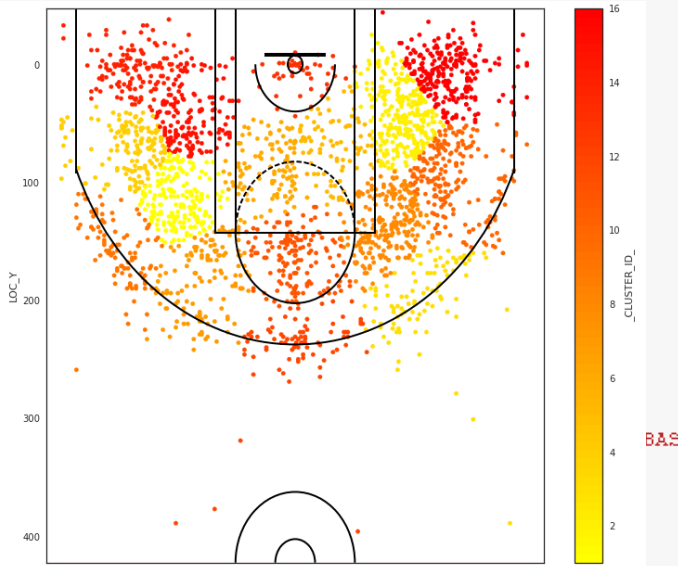
# How good was Jordan under pressure?

## Clustering the Court into Shot Zones using CAS action set

```
clust=sess.clustering.kClus(
      table={
          "name":"jordan_mining"
      },
      inputs={"LOC_X","LOC_Y_MINUS"},
      nClusters=30,
      maxIters=10,
      distanceNom="RELATIVEFREQ",
      estimateNClusters={
          "method":"ABC",
          "B":10,
          "minClusters":15,
          "criterion":"ALL",
          "align":"PCA"
      },
      kPrototypeParams={
          "method":"USERGAMMA",
          "value":10
      },

      output={"CasOut":{"name":"kClusOutputScore", "replace":True},
              "copyVars":{"LOC_X","LOC_Y","LOC_Y_MINUS","Made","Lead_Player
       ,
      display={"names":{"Modelinfo", "ClusterSumIntNom"}}

}
```



# How good was Jordan under pressure?

## Using CAS Regression to investigate performance under pressure

Logistic

In [69]:

```
lr = sess.regression.logistic(
  table={"name":"kClusOutputScore"},
  classVars=[{"vars":{"_CLUSTER_ID_","Lead_Player_Before", "Homegame", "ACTION_TYPE",  "end_of_game","Overtime","close_game","
  model={
    "depVars":[{"name":"Made", "options":{"event":"1"}}],
    "effects":[{"vars":{"SHOT_DISTANCE","_CLUSTER_ID_", "ACTION
  },

  outputTables={"names":"parameterestimates"}
)
sess.dataStep.runCode(
  code="""data round; set parameterestimates(keep=Parameter DF
do i = 1 to dim(_nums);
  _nums{i} = round(_nums{i},.001);
end;
drop i;
run;"""
)
sess.fetch(table="round")
```

Out[69]: **§ Fetch**

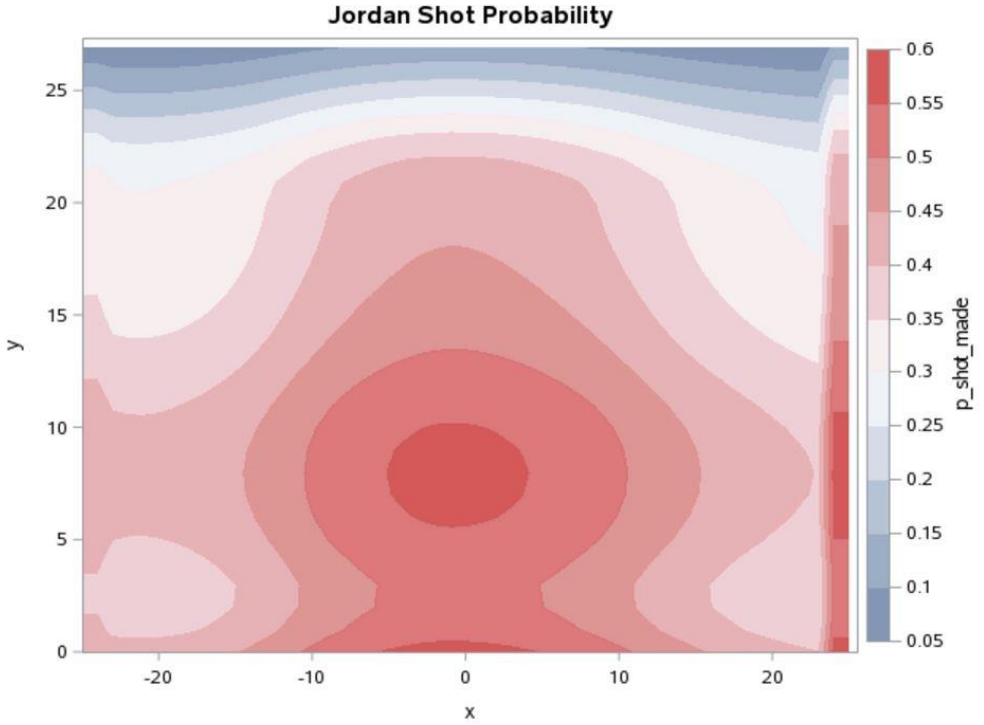
Selected Rows from Table ROUND

| | Parameter | DF | Estimate | StdErr | ChiSq | ProbChiSq |
|---|---|---|---|---|---|---|
| 0 | Intercept | 1.0 | 14.322 | 94.876 | 0.023 | 0.880 |
| 1 | pressure 1 | 1.0 | -0.385 | 0.188 | 4.193 | 0.041 |
| 2 | pressure 0 | 0.0 | 0.000 | NaN | NaN | NaN |
| 3 | Overtime Regular | 1.0 | 0.382 | 0.370 | 1.069 | 0.301 |
| 4 | Overtime Overtime | 0.0 | 0.000 | NaN | NaN | NaN |
| 5 | SHOT_DISTANCE | 1.0 | -0.035 | 0.014 | 6.500 | 0.011 |
| 6 | ACTION_TYPE Tip Shot | 1.0 | -13.135 | 94.875 | 0.019 | 0.890 |
| 7 | ACTION_TYPE Slam Dunk Shot | 1.0 | 0.027 | 128.564 | 0.000 | 1.000 |
| 8 | ACTION_TYPE Running Jump Shot | 1.0 | -12.634 | 94.876 | 0.018 | 0.894 |
| 9 | ACTION_TYPE Layup Shot | 1.0 | -13.064 | 94.875 | 0.019 | 0.890 |
| 10 | ACTION_TYPE Jump Shot | 1.0 | -14.106 | 94.875 | 0.022 | 0.882 |
| 11 | ACTION_TYPE Hook Shot | 1.0 | -12.552 | 94.882 | 0.017 | 0.895 |
| 12 | ACTION_TYPE Dunk Shot | 1.0 | -10.540 | 94.875 | 0.012 | 0.912 |
| 13 | ACTION_TYPE Driving Layup Shot | 1.0 | -11.510 | 94.875 | 0.015 | 0.903 |
| 14 | ACTION_TYPE Driving Dunk Shot | 0.0 | 0.000 | NaN | NaN | NaN |

# Analyse der NBA 1997 Daten durch 4 verschiedene Benutzer-Rollen

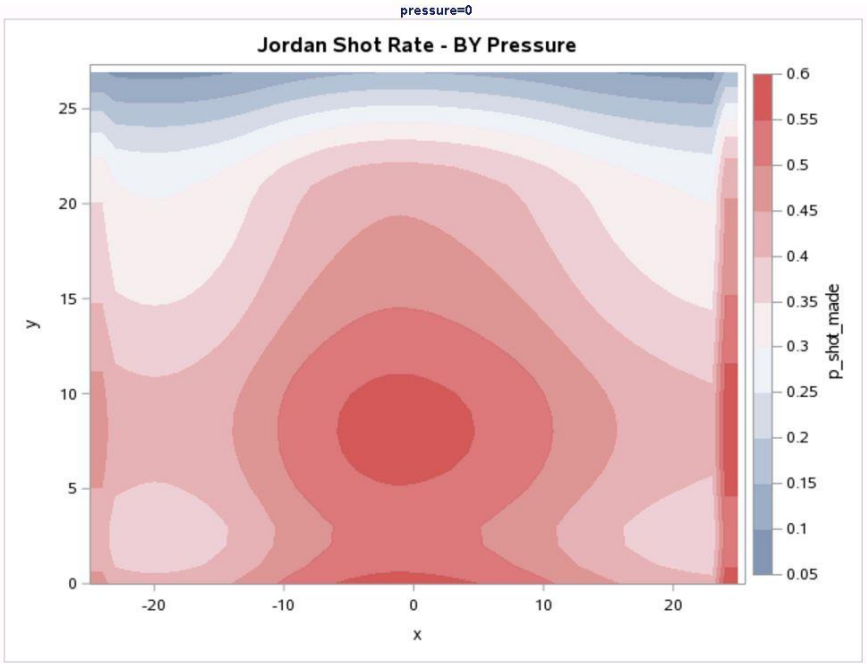
SAS Procedures für den SAS Data Scientist

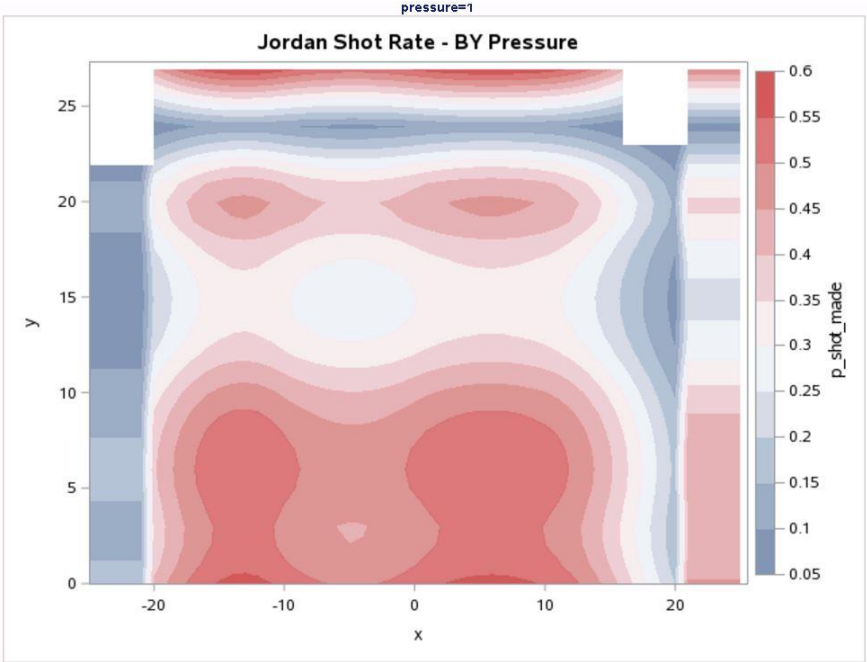
# Vorhersage der Treffer-Wahrscheinlichkeit von Jordan im [-25,25]x[0,27] Grid




```
proc logselect data=sfdcas.Jordan;
where Shot_Distance <= 30;
effect spl = spline(X Y / degree=2);
model Shot_Made(event='1') = spl ;
output out=sfdcas.Jordan_pred
pred=p copyvars=(x y shot_distance
shot_made);
Code file='/opt/sasinside/
DemoData/SFD/JordanPred_0.sas';
run;
```

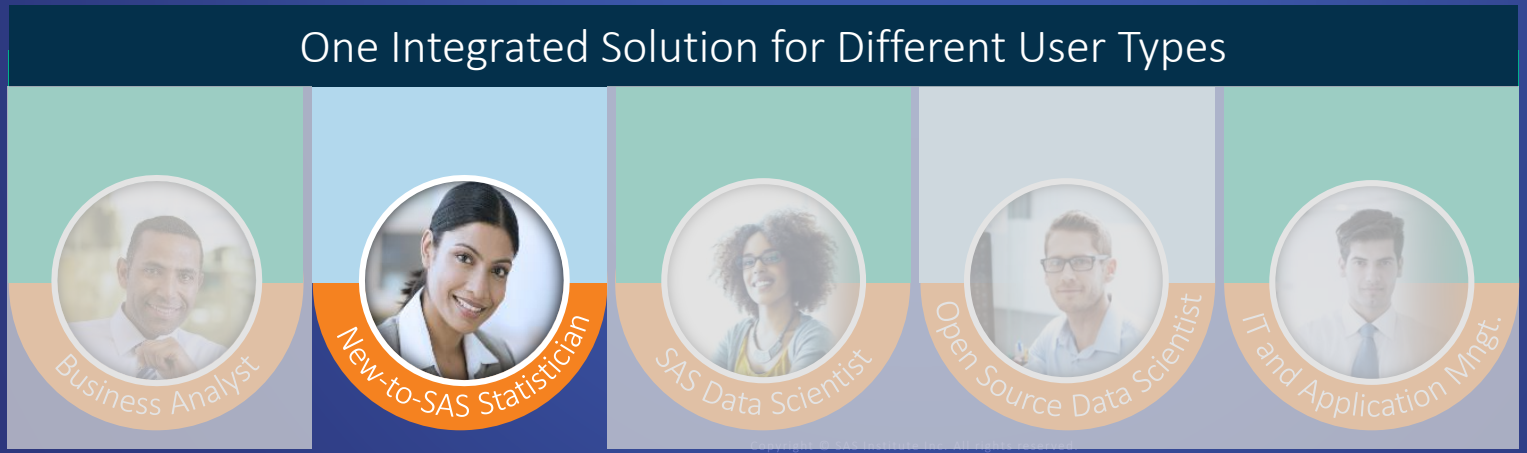
# Vorhersage der Treffer-Wahrscheinlichkeit von Jordan getrennt nach Pressure ja/nein



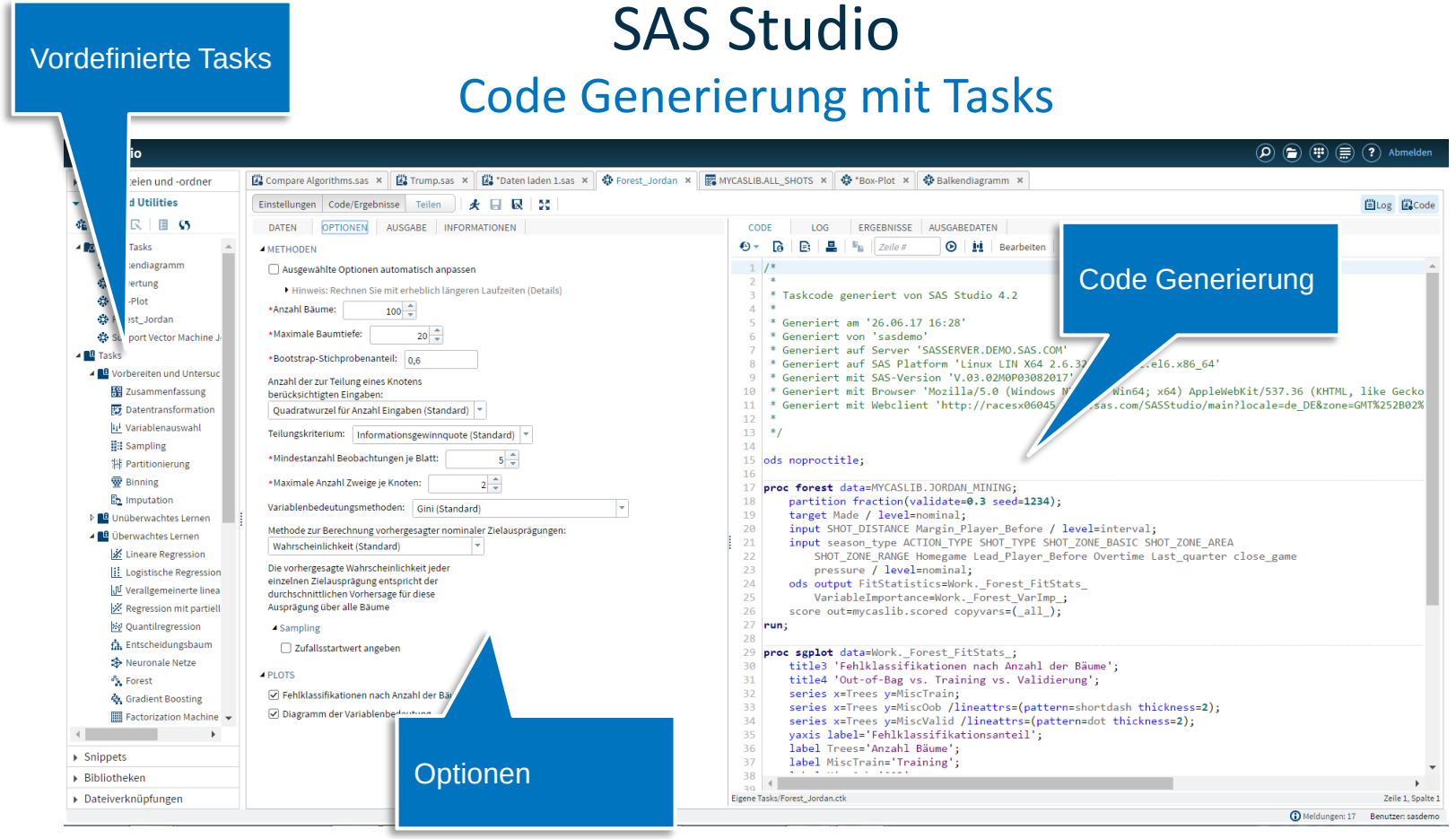
# Analyse der NBA 1997 Daten durch 4 verschiedene Benutzer-Rollen

Data Mining/Machine Learnings Tasks im SAS Studio für den „New-to-SAS“ Statistician



# SAS Studio

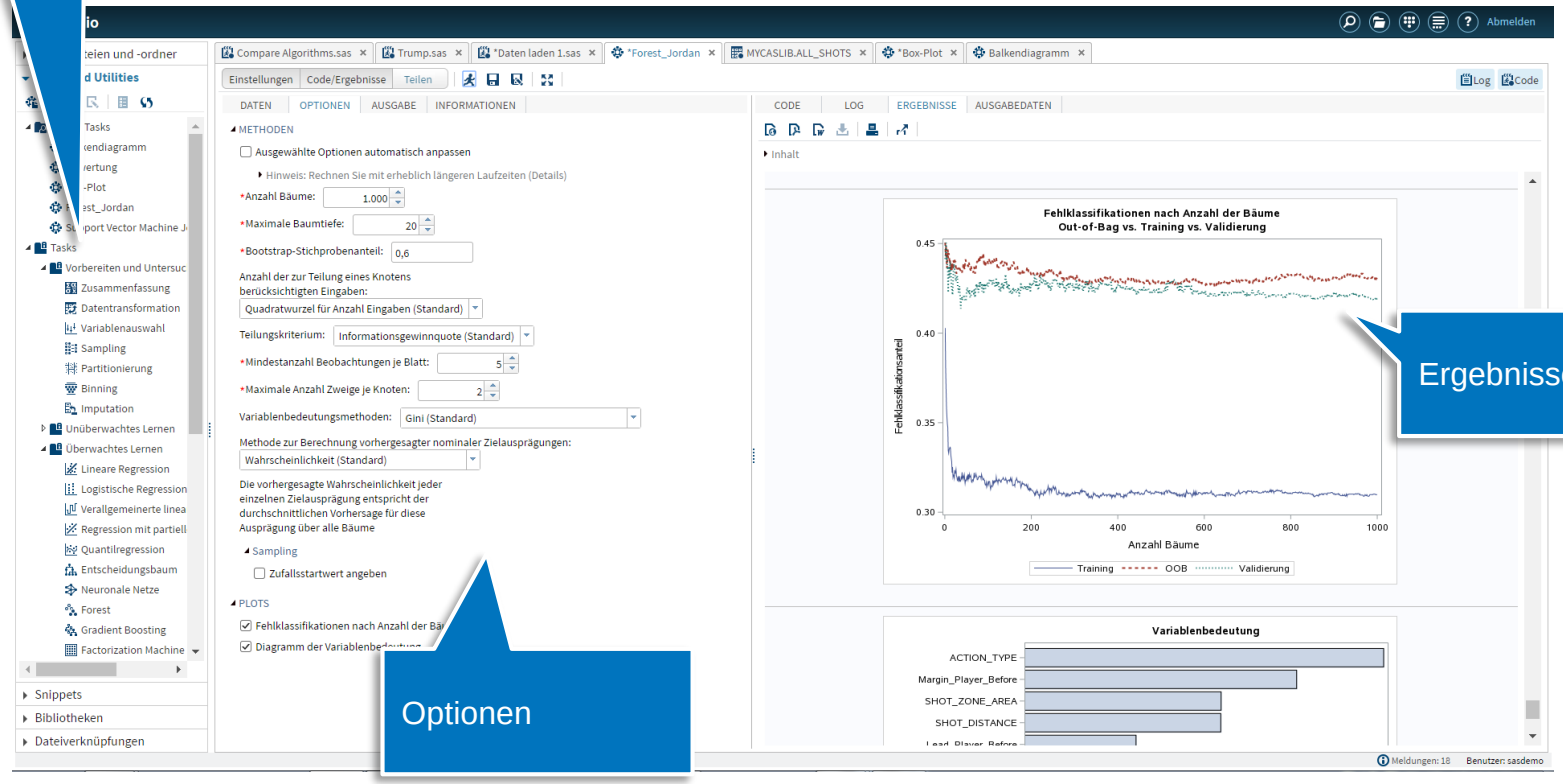
## Code Generierung mit Tasks



# SAS Studio

## Code Generierung mit Tasks

Vordefinierte Tasks

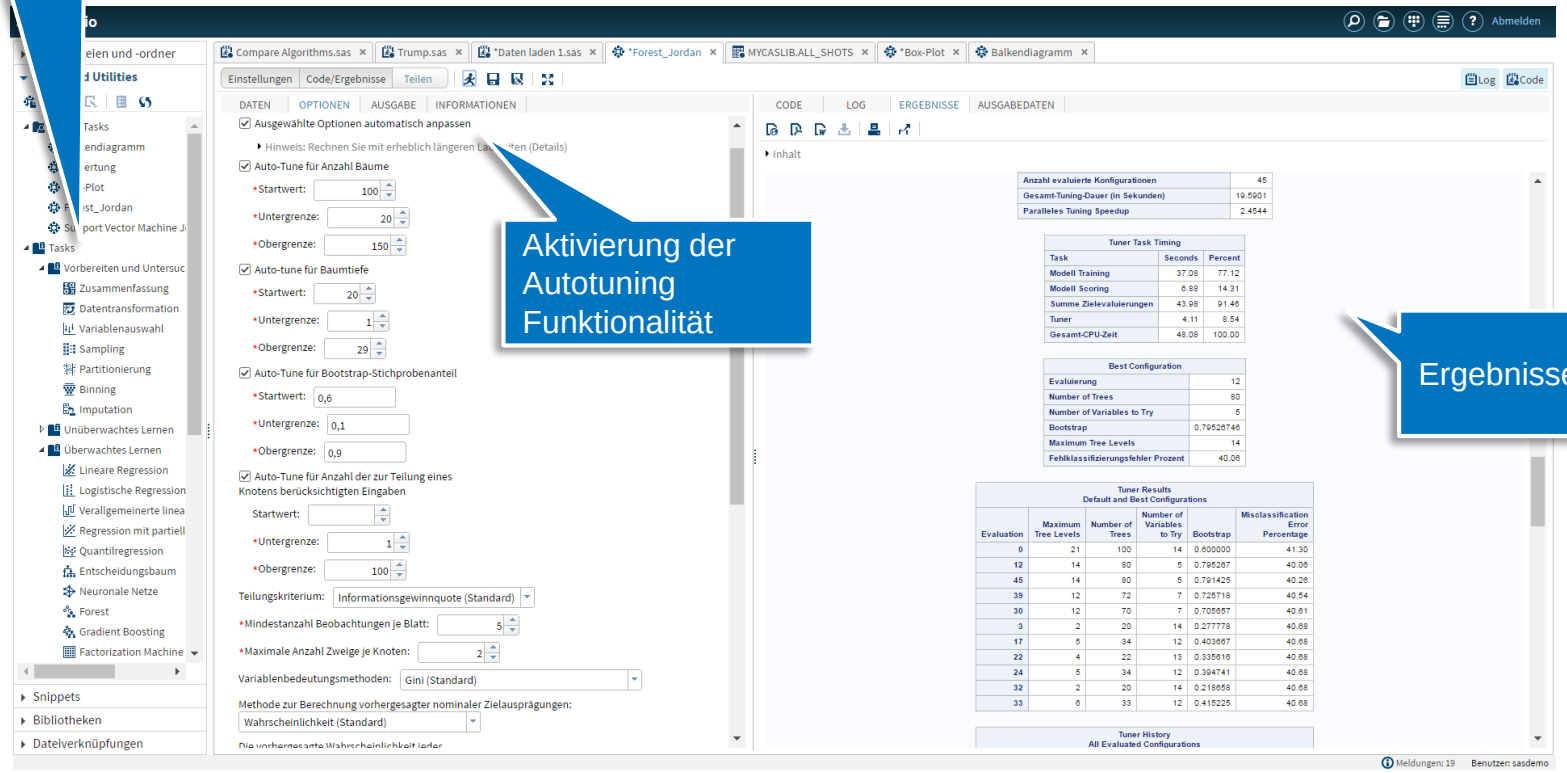



Ergebnisse

Optionen

# SAS Studio

## Code Generierung mit Tasks

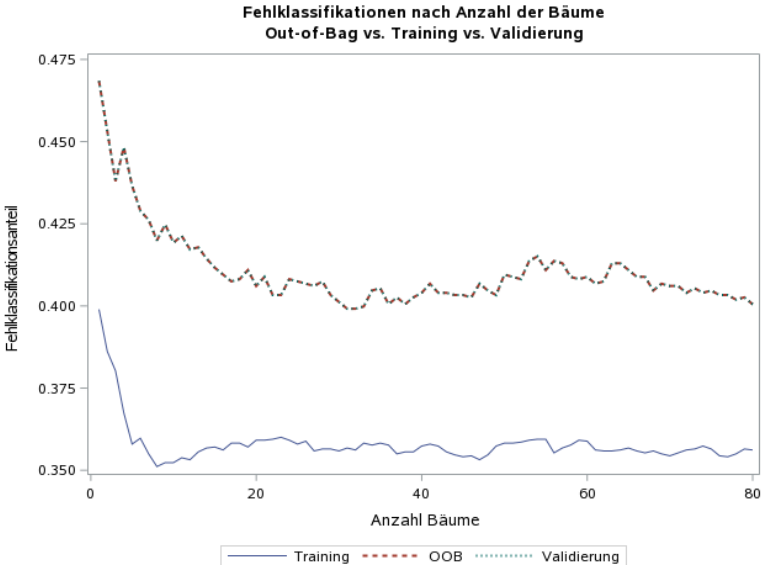


# SAS Studio

## Code Generierung mit Tasks

**Tuner Results**
**Default and Best Configurations**

| Evaluation | Maximum Tree Levels | Number of Trees | Number of Variables to Try | Bootstrap | Misclassification Error Percentage |
|---|---|---|---|---|---|
| 0 | 21 | 100 | 14 | 0.600000 | 41.30 |
| 12 | 14 | 80 | 5 | 0.795267 | 40.06 |
| 45 | 14 | 80 | 5 | 0.791425 | 40.26 |
| 39 | 12 | 72 | 7 | 0.725718 | 40.54 |
| 30 | 12 | 70 | 7 | 0.705657 | 40.61 |
| 3 | 2 | 20 | 14 | 0.277778 | 40.68 |
| 17 | 5 | 34 | 12 | 0.403667 | 40.68 |
| 22 | 4 | 22 | 13 | 0.335616 | 40.68 |
| 24 | 5 | 34 | 12 | 0.394741 | 40.68 |
| 32 | 2 | 20 | 14 | 0.218658 | 40.68 |
| 33 | 6 | 33 | 12 | 0.415225 | 40.68 |



# SAS Studio

## Code Generierung mit Tasks