7th UCAAT User Conference on Advanced Automated Testing

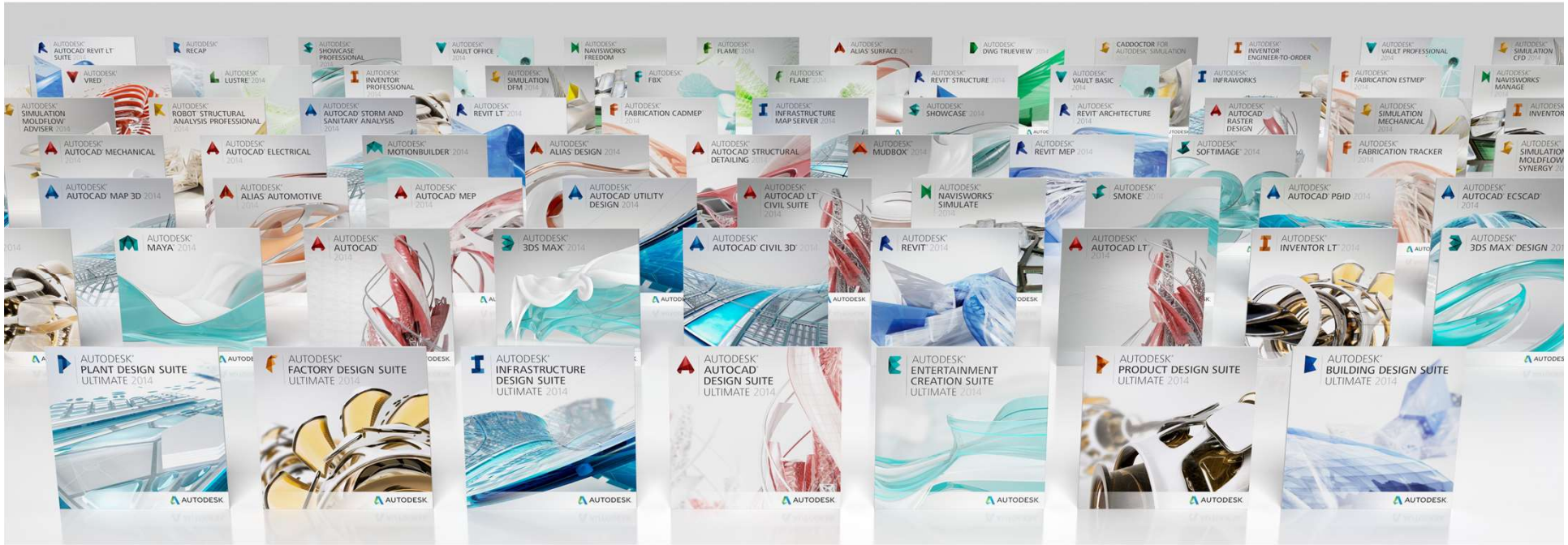
ETSI

IMPROVING AUTOMATED TESTING ACCURACY WITH MACHINE LEARNING

Presented by Justin Lawler & Mirjana Radovanov

AUTODESK

Introduction to Autodesk



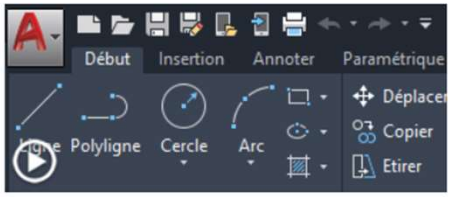
Localization in Autodesk

- 90+ Products & Services on different technologies
- 16 languages
- Content : Software, Documentation, Videos, Web sites, Forums, AKN (Autodesk Knowledge Network), Marketing campaign, Training material

Localization in Autodesk

Vidéos de présentation des nouvelles fonctions et de l'interface utilisateur.

Nouvelles fonctionnalités



Présentation de l'interface utilisateur

Avez-vous essayé...

Zoom et panoramique plus rapides
Utilisation d'AutoCAD où que vous soyez
Barre d'état
Suite...

Apprentissage

Nouveautés
Fondamentaux sur les fonctions de base

Aide-mémoires

Commandes | Nouveau | Mis à jour | Obsolète
Variables système | Nouveau | Mis à jour | Obsolète
Express Tools
Raccourci | Touches de remplacement temporaire

Ressources

「新功能」和「使用者介面概述」視訊

新功能

使用者介面概述

您是否已嘗試過

更快速縮放和平移
在任何地方使用 AutoCAD
狀態列
更多...

學習

新增功能
AutoCAD 基礎快速指南
更新的說明主題
培訓和認證

連接

Autodesk Community

快速參考

指令 | 新增 | 更新 | 舊型
系統變數 | 新增 | 更新 | 舊型
Express Tools
捷徑 | 暫時取代鍵

資源

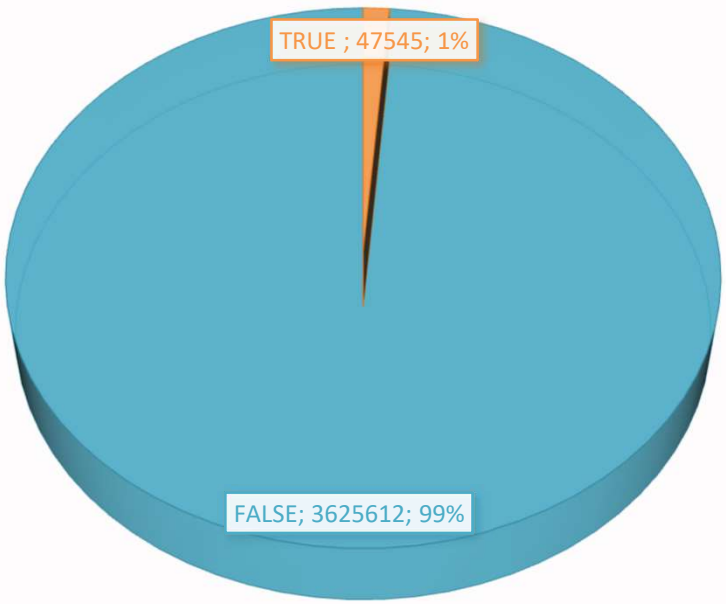
自訂 | CAD 管理
開發商文件
發行說明 | 系統需求
辭彙
常見問題

下載

Automated Localization Testing

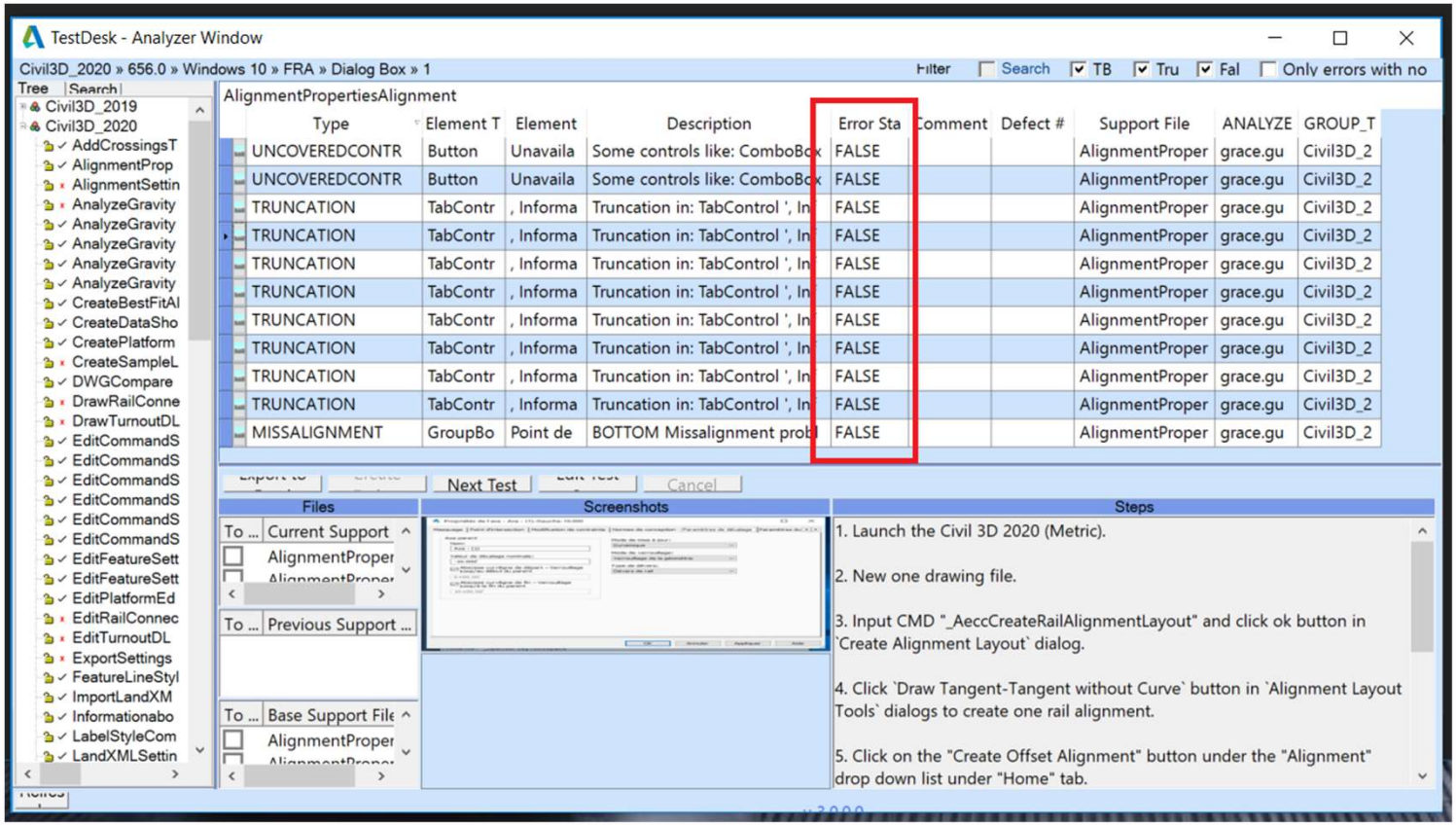
- LAGT (Localization Autodesk UI Testing)
  - Test Cases: 963 (AutoCAD)
  - Products: 30
  - Languages: 16
  - Builds per year: 3
- Manual Analysis and Verification
  - TestDesk
  - 20 Years Old - Need to Retire
- Manually Very Intensive

Automated Localization Testing - 2018



~**<u>4 Million</u>** Errors Flagged by LAGT Tool (All Products)

TestDesk Automated Localization Testing



Civil3D_2020 » 656.0 » Windows 10 » FRA » Dialog Box » 1

AlignmentPropertiesAlignment

Type	Element T	Element	Description	Error Sta	Comment	Defect #	Support File	ANALYZE	GROUP_T
UNCOVEREDCONTR	Button	Unavaila	Some controls like: ComboBox	FALSE			AlignmentProper	grace.gu	Civil3D_2
UNCOVEREDCONTR	Button	Unavaila	Some controls like: ComboBox	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
TRUNCATION	TabContr	, Informa	Truncation in: TabControl ', In	FALSE			AlignmentProper	grace.gu	Civil3D_2
MISSALIGNMENT	GroupBo	Point de	BOTTOM Missalignment probl	FALSE			AlignmentProper	grace.gu	Civil3D_2

1. Launch the Civil 3D 2020 (Metric).

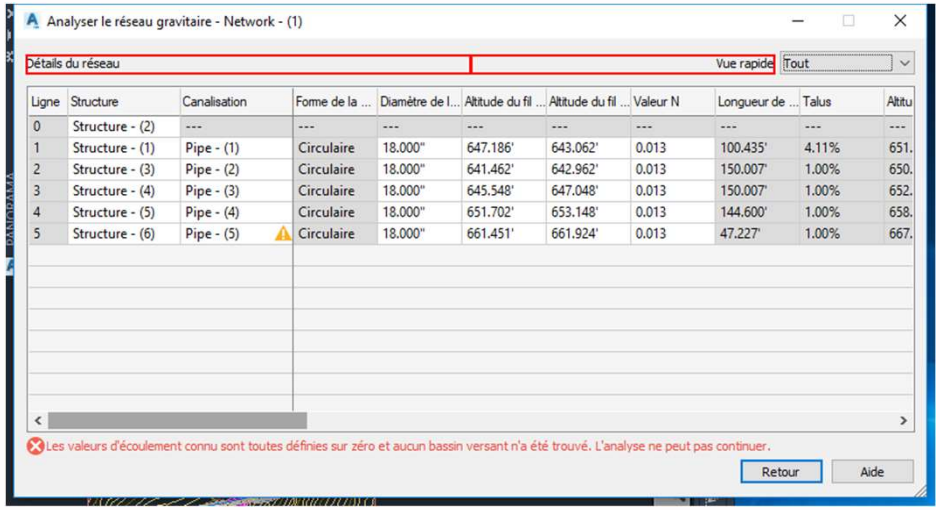
2. New one drawing file.

3. Input CMD "_AeccCreateRailAlignmentLayout" and click ok button in `Create Alignment Layout` dialog.

4. Click `Draw Tangent-Tangent without Curve` button in `Alignment Layout Tools` dialogs to create one rail alignment.

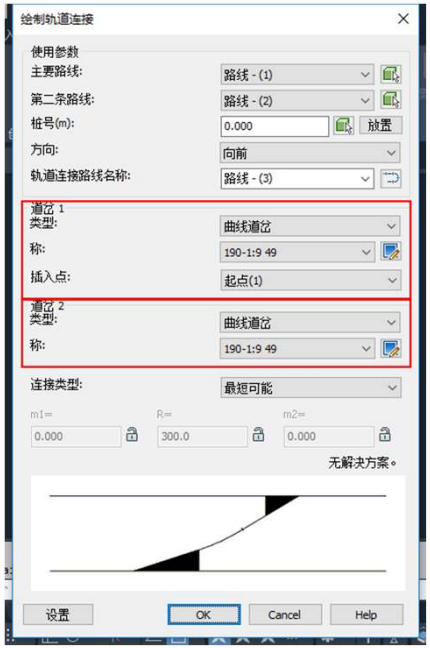
5. Click on the "Create Offset Alignment" button under the "Alignment" drop down list under "Home" tab.

Localization Errors – false positive examples



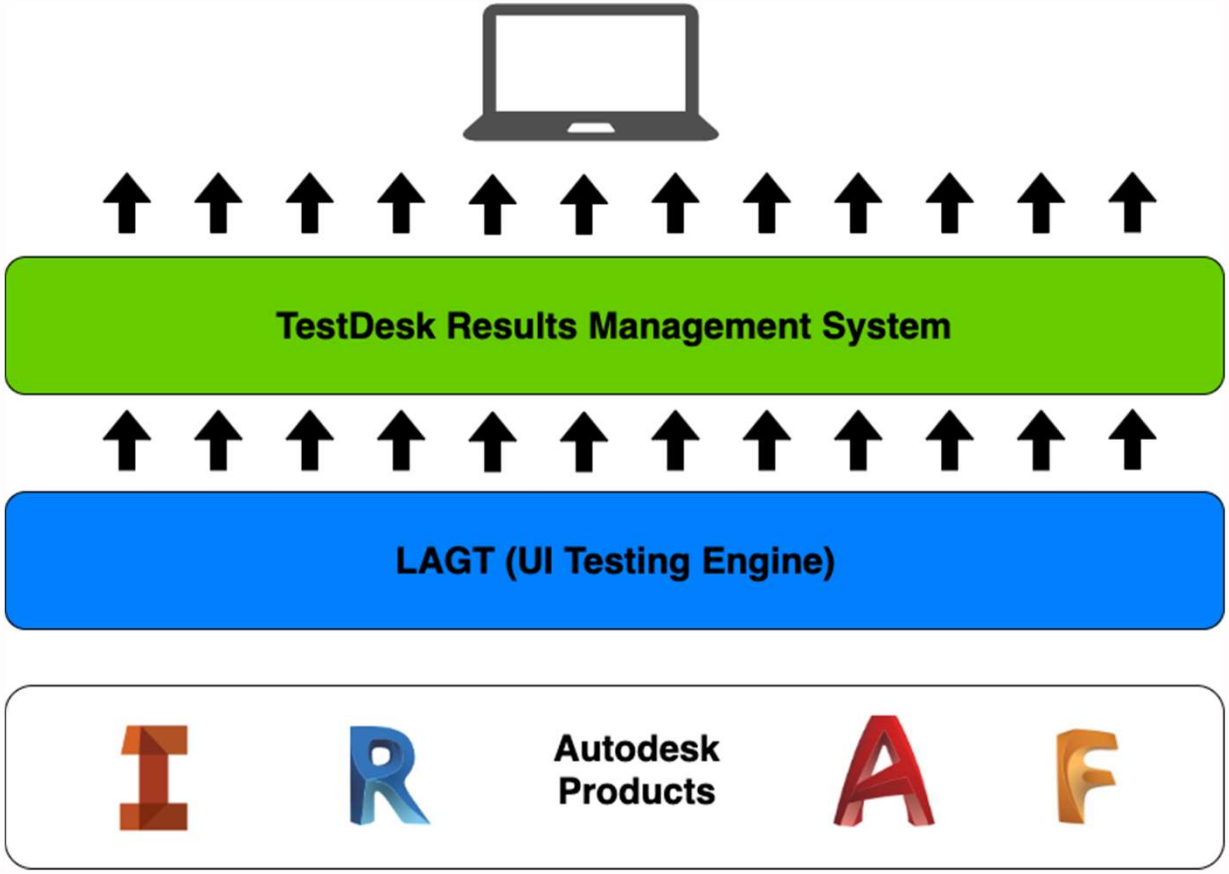
Ligne	Structure	Canalisation	Forme de la ...	Diamètre de l...	Altitude du fil ...	Altitude du fil ...	Valeur N	Longueur de ...	Talus	Altitu
0	Structure - (2)	---	---	---	---	---	---	---	---	---
1	Structure - (1)	Pipe - (1)	Circulaire	18.000"	647.186'	643.062'	0.013	100.435'	4.11%	651.
2	Structure - (3)	Pipe - (2)	Circulaire	18.000"	641.462'	642.962'	0.013	150.007'	1.00%	650.
3	Structure - (4)	Pipe - (3)	Circulaire	18.000"	645.548'	647.048'	0.013	150.007'	1.00%	652.
4	Structure - (5)	Pipe - (4)	Circulaire	18.000"	651.702'	653.148'	0.013	144.600'	1.00%	658.
5	Structure - (6)	Pipe - (5)	Circulaire	18.000"	661.451'	661.924'	0.013	47.227'	1.00%	667.

Truncation Error (French)

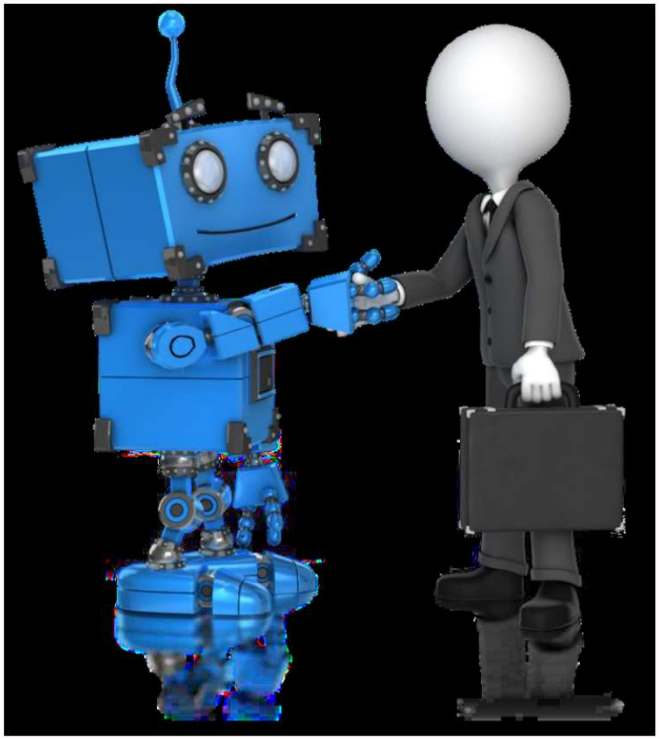


Overlapping Error (Chinese)

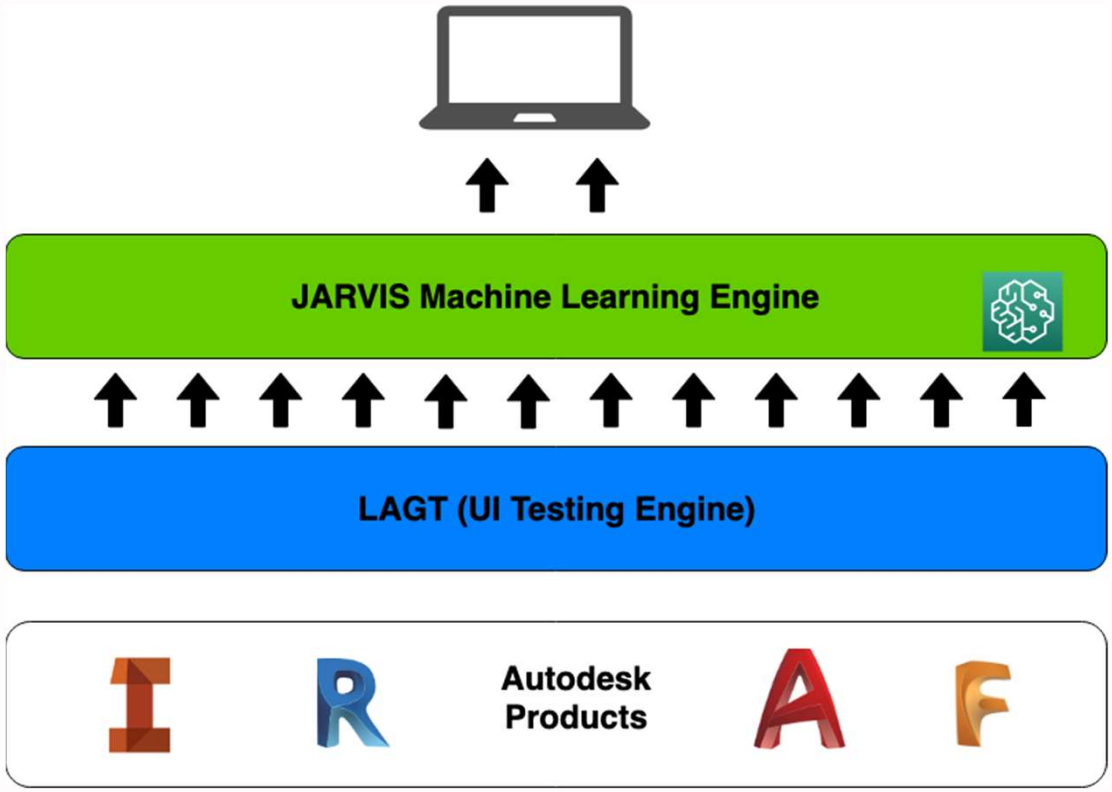
The Problem

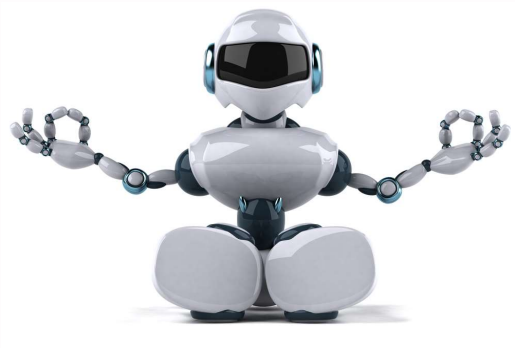


The Solution – Augmented Intelligence

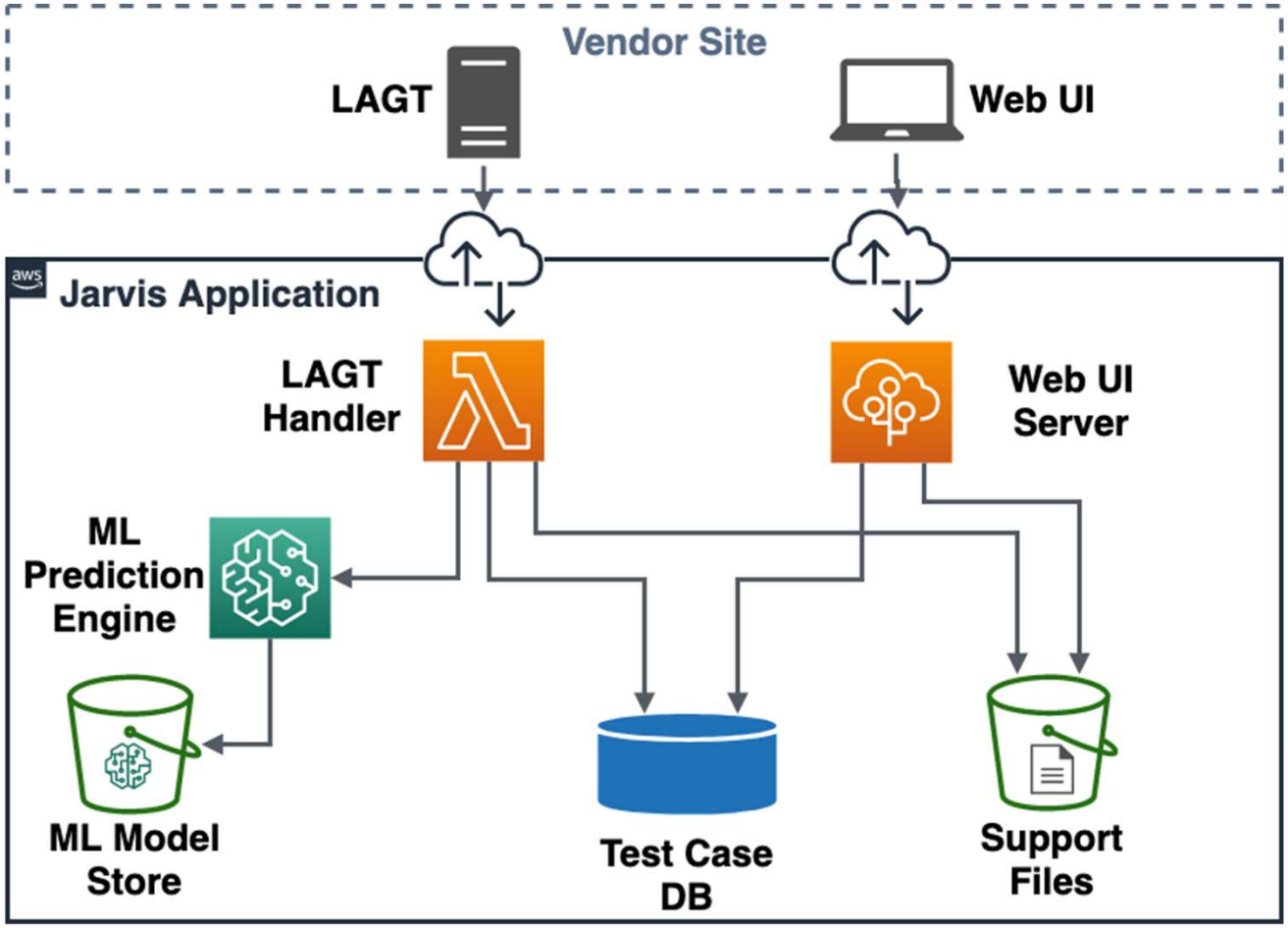


The Solution - Jarvis





JARVIS - Architecture



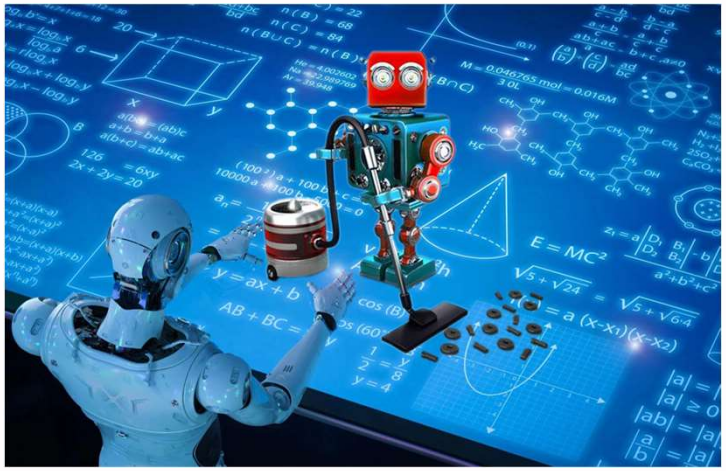
Building Machine Learning Model

- 8 years of Labeled Data
- >20 Error Types
- Data Stored as
  - Oracle Database
  - XML Files

Machine Learning Pipeline

ML Pipeline - Data Cleaning

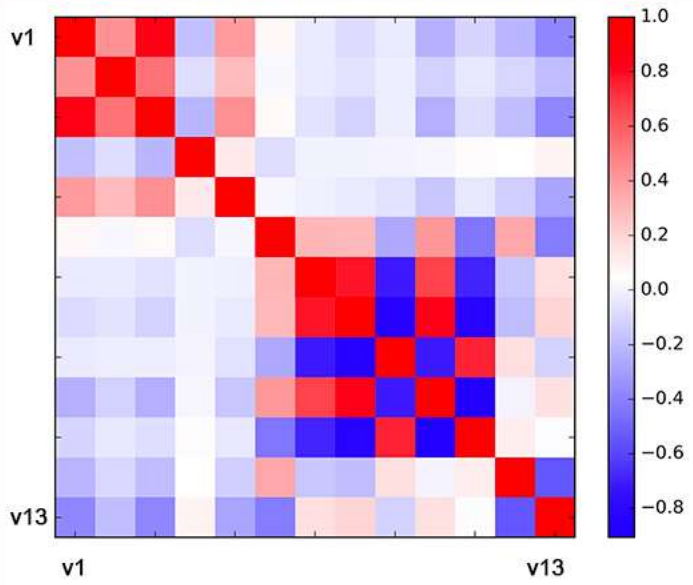
- Remove Duplicate Rows
- Remove Null Values
- Remove Rows with Bad Data
- Remove Constant Columns
- Remove Irrelevant Columns



Data Extraction → Data Cleaning → Feature Extraction → Model Training → Model Validation

ML Pipeline - Feature Selection

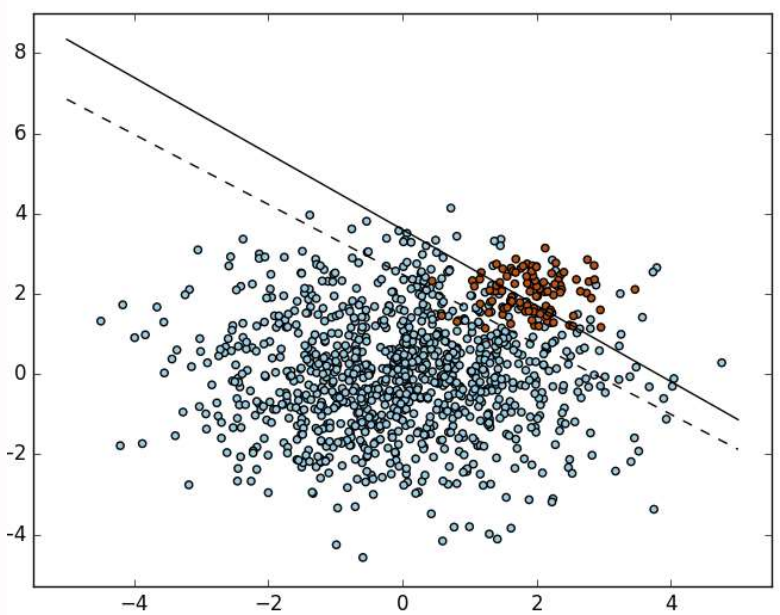
- Manually Selected
  - Relevant Inputs Only
- Calculated
  - Remove Highly Correlated Features



Data Extraction → Data Cleaning → Feature Extraction → Model Training → Model Validation

ML Pipeline - Algorithm Selection

- Binary Classification Problem
- > 60 Input Parameters
- Highly Imbalanced Data Set
- Cannot Miss-Diagnose a True Error



ML Pipeline: Algorithm Selection

- Algorithms Tried
  - Random Forest
  - XGBoost
  - CatBoost

Data Extraction → Data Cleaning → Feature Extraction → **Model Training** → Model Validation

ML Pipeline - Algorithm Selection - CatBoost

- Open-sourced machine learning algorithm
- Why CatBoost
  - Lots of categorical features in the data set
  - Faster Development
    - Better Defaults
  - Handles Imbalanced Data Sets

Yandex CatBoost

ML Pipeline – Model Training

- Truncation Model
  - 2M Rows Raw Data
- Data Split
  - Training on 75%
  - Validation on 25%
- Trained on AWS Sagemaker

Data Extraction → Data Cleaning → Feature Extraction → **Model Training** → Model Validation

ML Results CATBoost – Confusion Matrix*

	Predicted True	Predicted False
Actual False	3.6% (35,415)	96.4% (956,073)
Actual True	87.4% (6,195)	12.6% (896)

* Results for Truncation Errors Only

Jarvis Result Server – User Interface

No.	Error Type	Element Name	Element Type	Description	Error Status	Conf. %	Comment	Defect	Support File	Analyzed by
142	DLG_UNKN...	DUMMY	DialogBox	Unable to ...	TO BE ANAL...	90 %		Create		
143	HARNESS_E...	SilkTest	SilkTest	This testca...	TO BE ANAL...	70 %		Create	Harness_Er...	

Challenges Faced

- Data Set Size
- Imbalanced Data Sets
- Extracting Legacy Data

Takeaways – Was It Worth It?

- Reduce Turn-Around Time
- Reduces Human Touch-Points
- Replaces Legacy (20 year old) System
  - New User Interface
  - Cloud Based
  - New Database
  - Fix Security Problems
- Cost Savings are a By-Product

Q&A