AUTOMATION OF IT SERVICE MANAGEMENT AT JOHNSON & JOHNSON

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ML1030 Capstone Course

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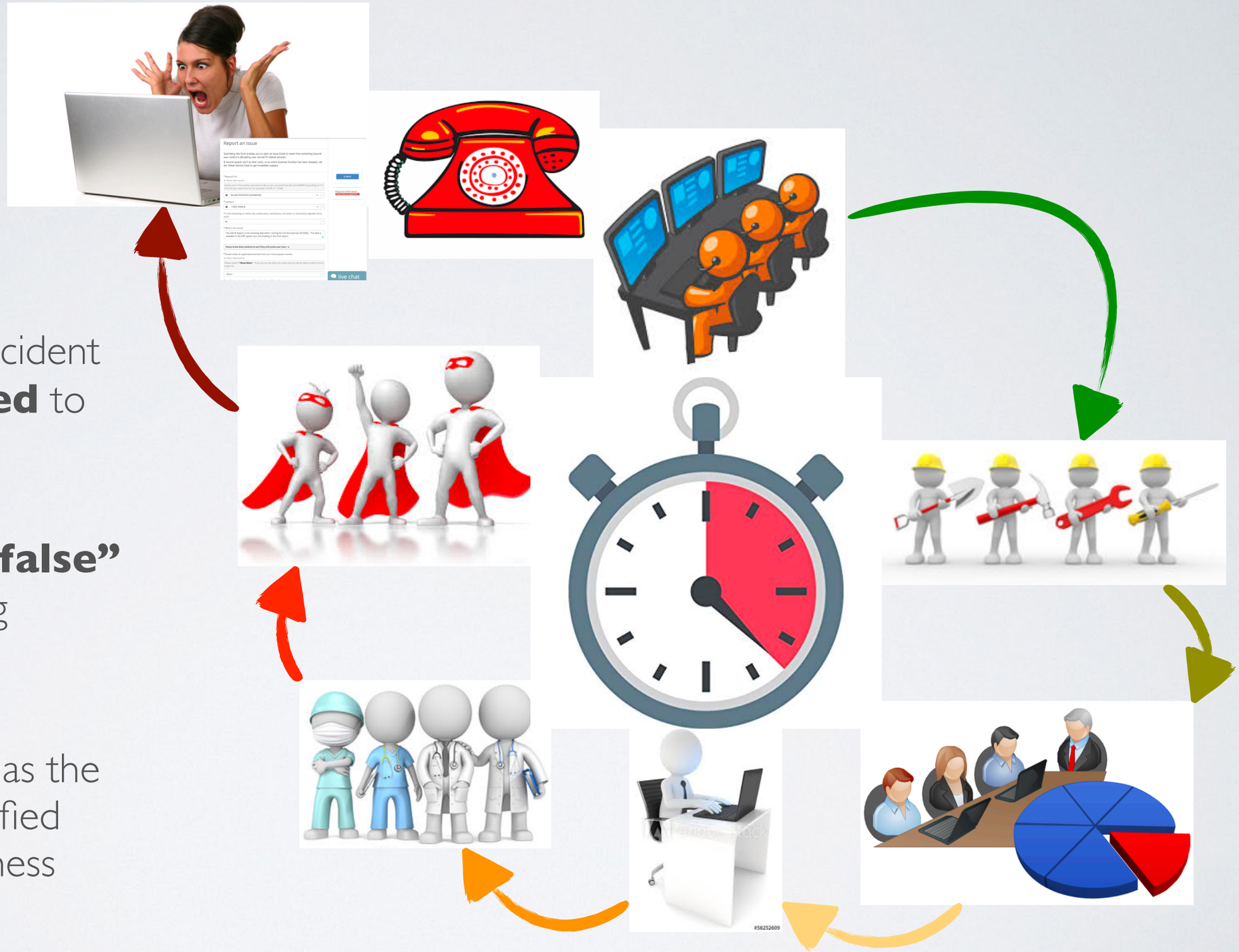
MLCapstone Course - September 9, 2019

AGENDA

- The Problem
- Motivation
- The Final Goal
- Benefits
- Model Creation Process
- Data Set
- Data Preparation and Analysis
- Results
- Deployment + Demo
- Conclusions

THE PROBLEM

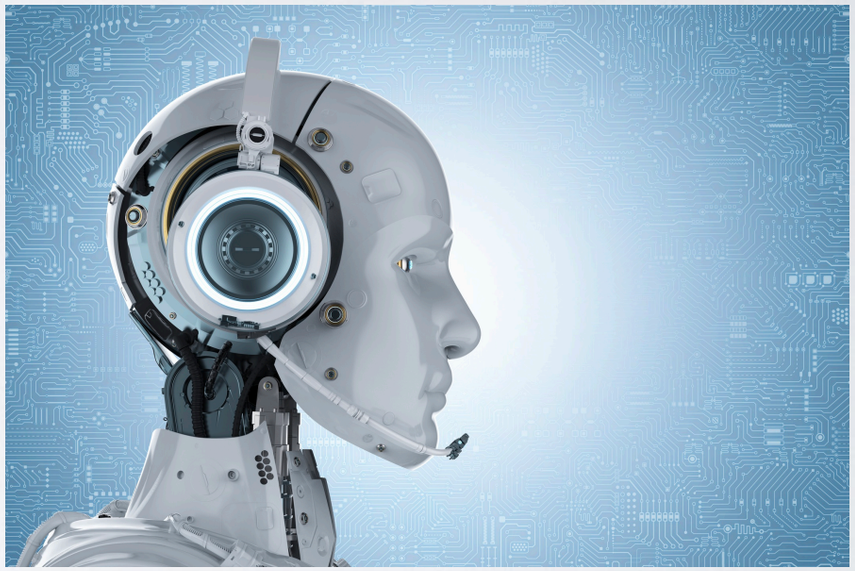


- Almost **10–15%** of incident tickets are **not routed** to the right team
- Tickets created with **“false” low priority** causing multiple escalations
- The **MTTR is high** as the resolution is not identified promptly causing business impact and exhausting resources

MOTIVATION

What is ITSM?

- IT Service Management (ITSM) is a process-based practice intended to align the delivery of information technology (IT) services with needs of the organization, emphasizing benefits to customers. ITSM involves a paradigm shift from managing IT as stacks of individual components to focusing on the delivery of end-to-end services using best practice process models.



Objective

- **Prototype** a ML-based **process automation** to associate the reported issue to previous incidents and **predict a solution** referring to the fields used to log the resolution of the incident. This prediction will be used by ServiceDesk to determine the best course of action including Support team and criticality.

THE FINAL GOAL

servicenow

Johnson&Johnson INFORMATION TECHNOLOGY

IRIS: YOUR SELF-SERVICE PORTAL

Search Iris...

Live Chat

Report an issue

Submitting this form enables you to open an issue ticket to report that something beyond your control is disrupting your normal IT-related services.

If several people can't do their work, or an entire business function has been stopped, call the Global Service Desk to get immediate support.

SUBMIT

*Request For

More information

Names are in First Name Last name order or you can search by last name/WWID by putting an * in front of your search terms. For example *Smith or *12345

BALANO BONIFACIO (642000262)

*Location

1 FIRST AVENUE

*Is this impacting an entire site, a laboratory, warehouse, call center or manufacturing/sales force area?

No

*What is the issue?

The SAP BI Report is not showing data when running for the fiscal period 2019/002. The data is available in the ERP system but not showing in the final report.

Please review these solutions to see if they will resolve your issue:

*Please select an application/service from our most popular choices

More information

Please select "--Show More--" if you do not see what you need and you will be able to select from a larger list

-- None --

Flask

web development, one drop at a time

ITSM Incident Description

127.0.0.1:5000

Apps | Machine Learning | Home | J&J Home | ITSM Incident Des... | Aikido | JnJ | Mail - jmelo2@ITS... | Music Genre Reco...

ITSM Classification Prediction

The SAP BW Report is not showing data when running for the fiscal period 2019/002. The data is available in the ERP system but not showing in the final report.

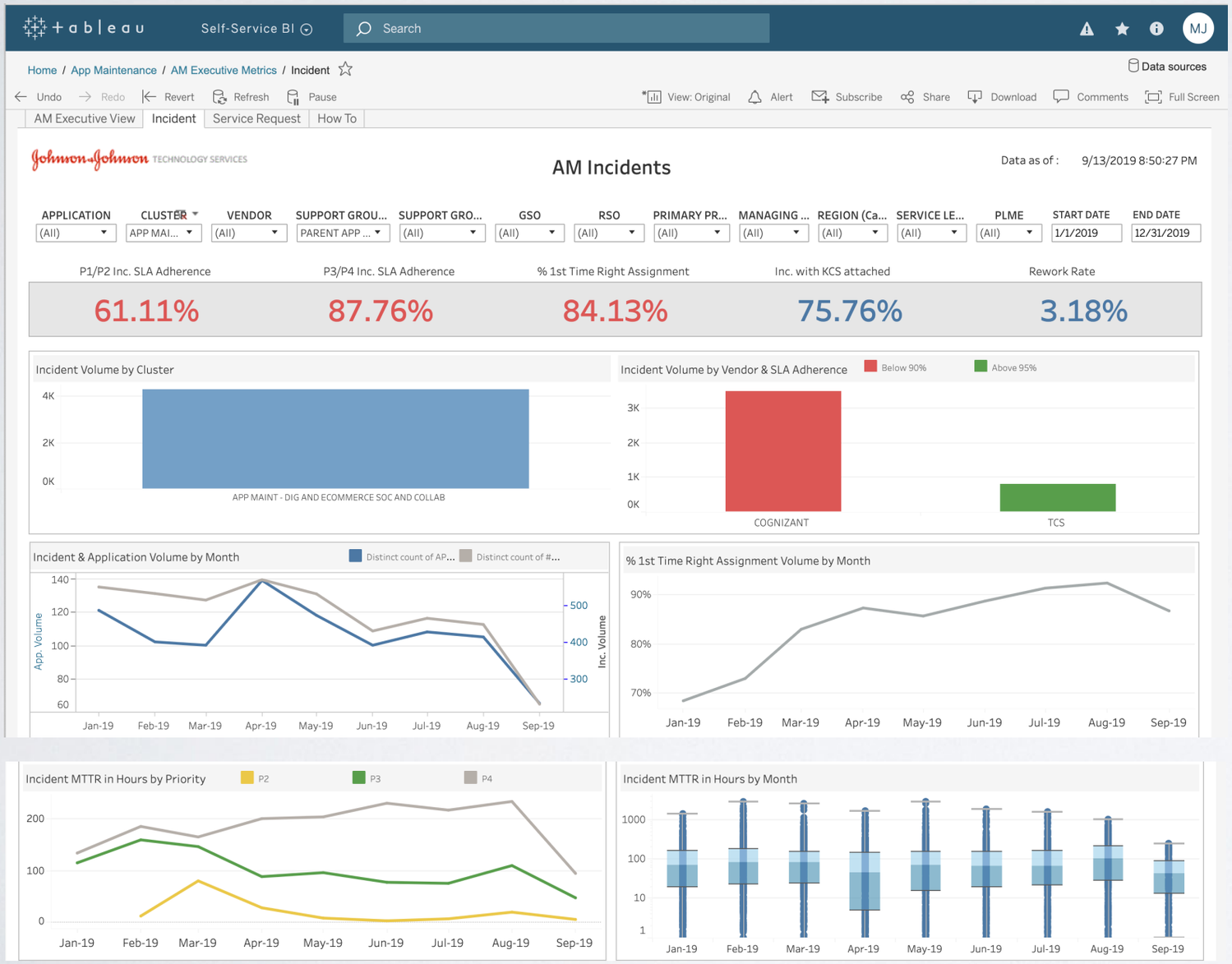
Submit

Prediction

Type	Prediction	Probability
Category	Application	0.82153076
Sub Category	Job Failure	0.6096731
Priority	Priority 3	0.84753317
Support Group	GLOBAL ANALYTICS PHARMA	0.37585497
Resolution Category	Configuration Error	0.23389834
Potential Knowledge Article	KB000010043741	0.06389465

live chat

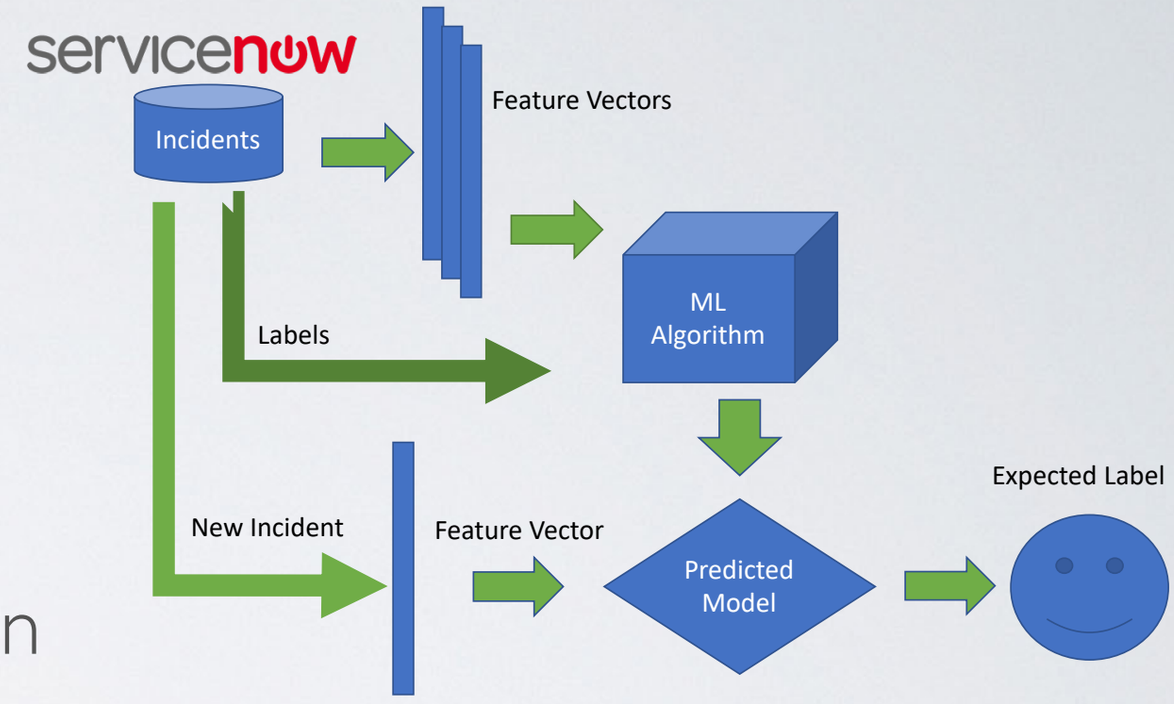
BENEFITS

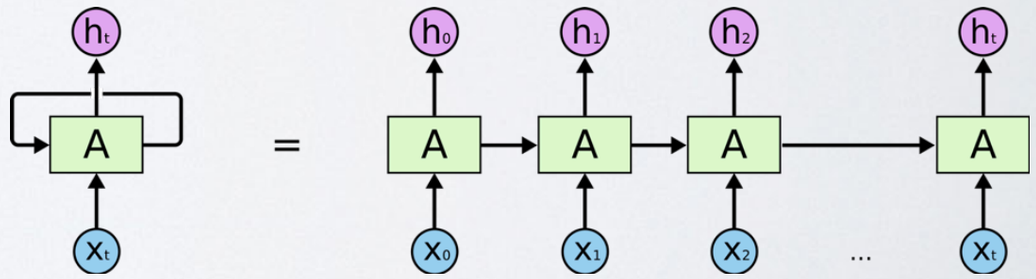


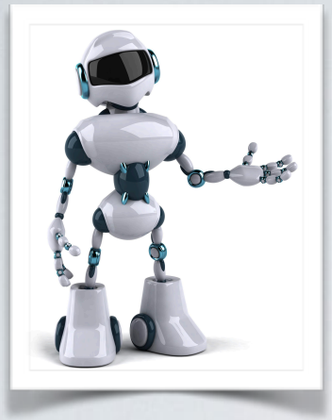
- Increase first time right assignment 90%
- Increase SLA% over 95%
- Reduce MTTR to 10-50hrs
- Increase visibility of Ticket resolution
- Uncover hiden connexions of the incidents
- Speed-up RCA resolution
- Better use of current human resources

MODEL CREATION PROCESS

1. Training text: the ticket description
   A. Training 70% - Testing 30%
2. Feature Vector containing information describing the characteristics of the input data.
3. Labels: Predefined categories the model will predict
4. ML Algorithm: RNN for classification
5. Creation of the Predictive Model trained using the historical dataset



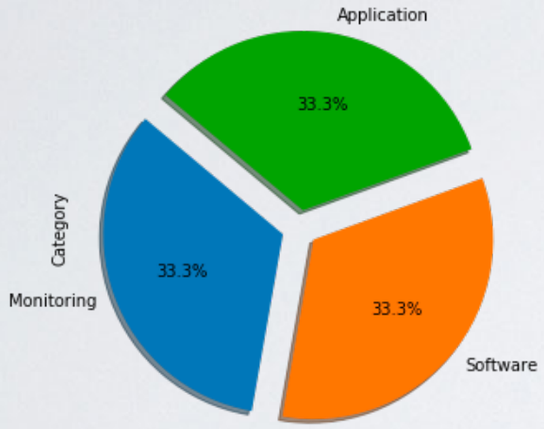




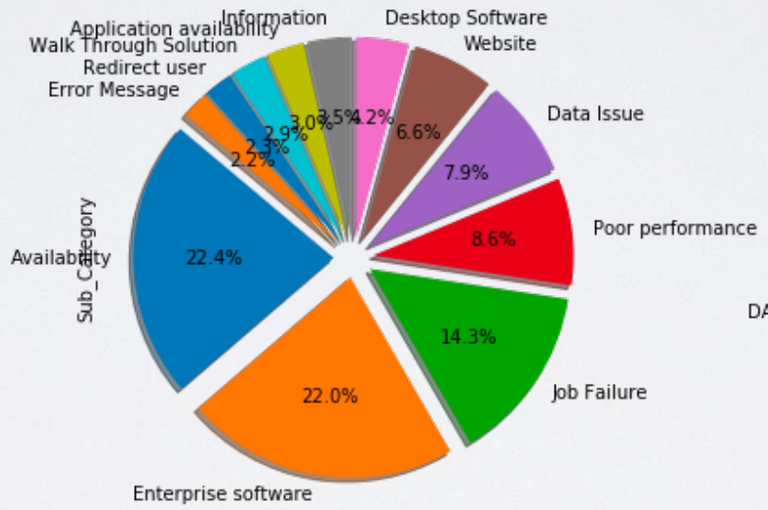
DATA SET

56077 observations extracted from ITSM System
Two product lines: Digital and Analytics
Incident description

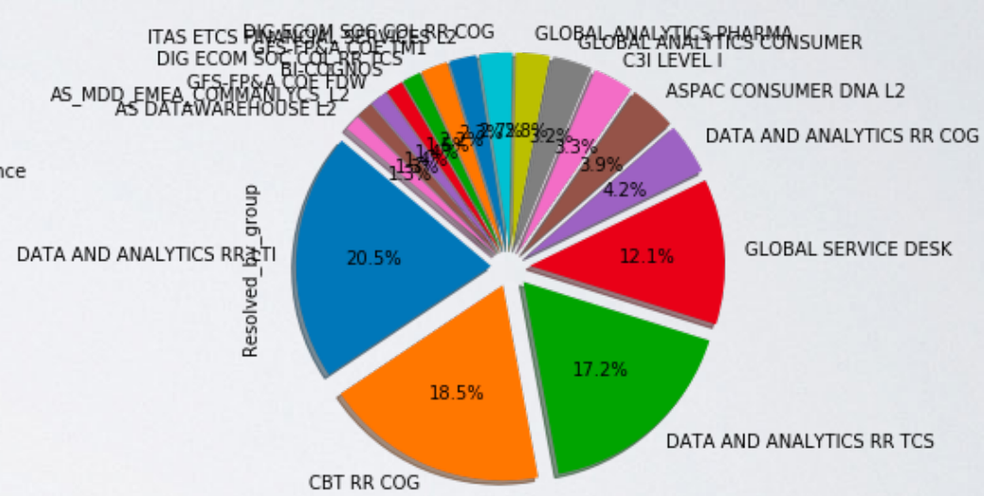
Category
Subsample 81% of the data set = 45675



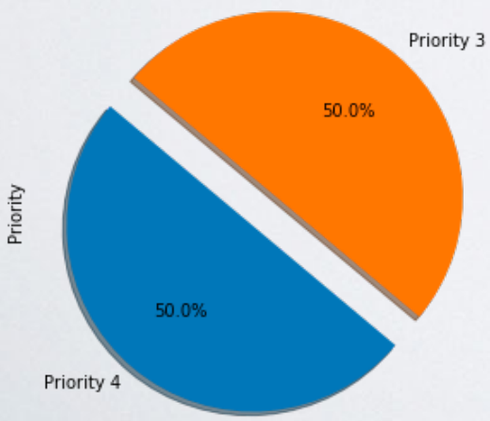
Sub-Category: 12 Levels
Subsample 63% of the data set = 51872



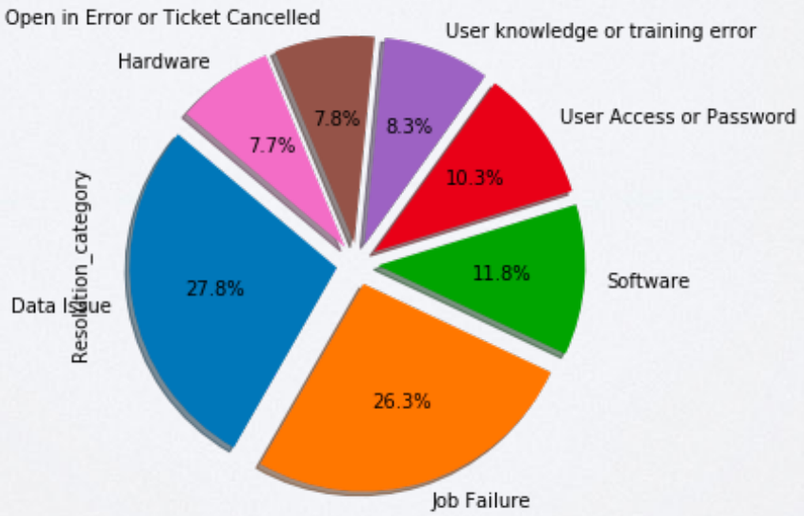
Resolved by Group: 17 Levels
Subsample 73% of the data set = 41363



Priority
Subsampling: 80% of the data set= 44990



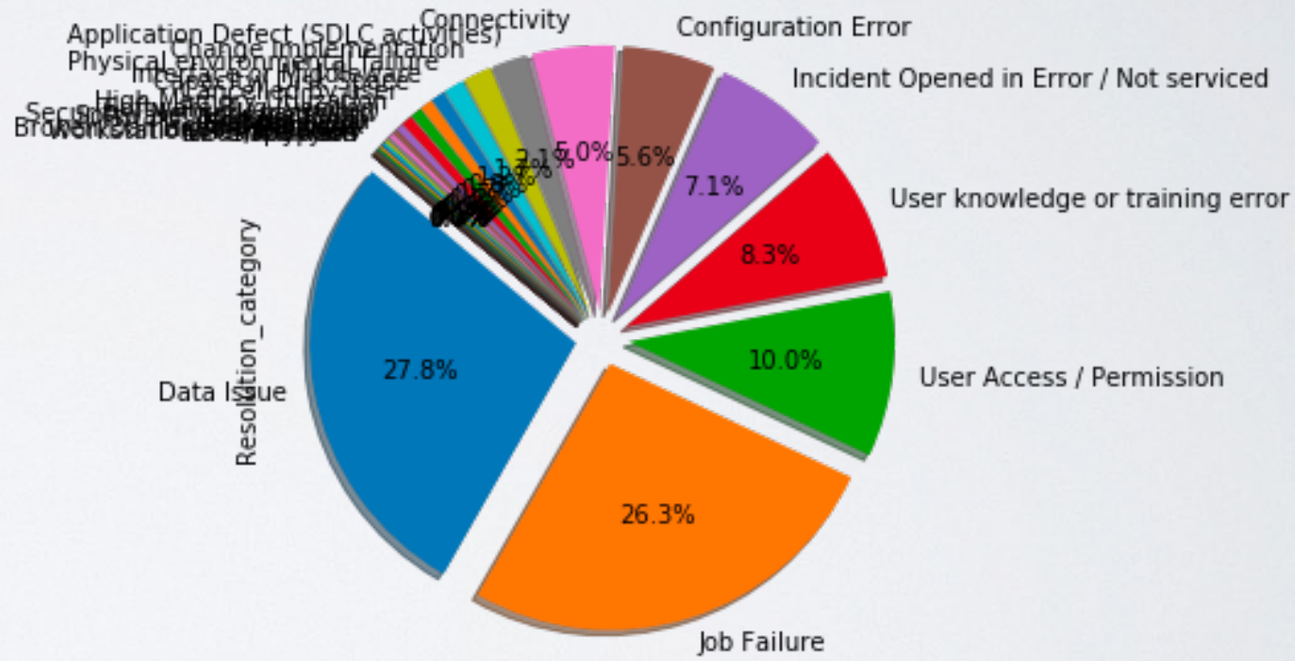
Resolution Category: 7 Levels
All data - Recategorized



Knowledge Article
52% tickets = 29239

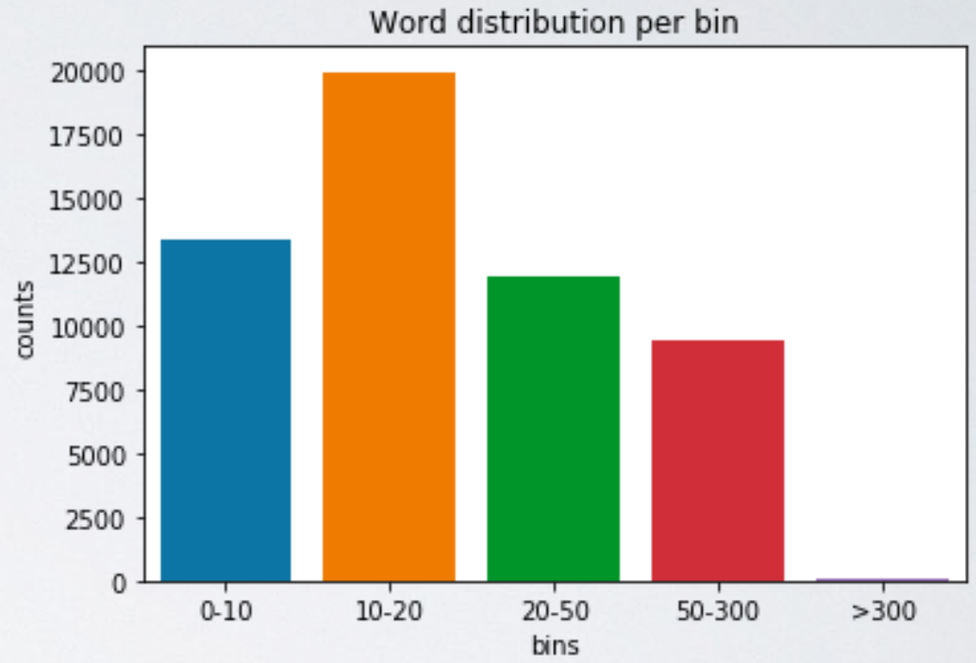
RE-CLASSIFICATION OF RESOLUTION CATEGORY

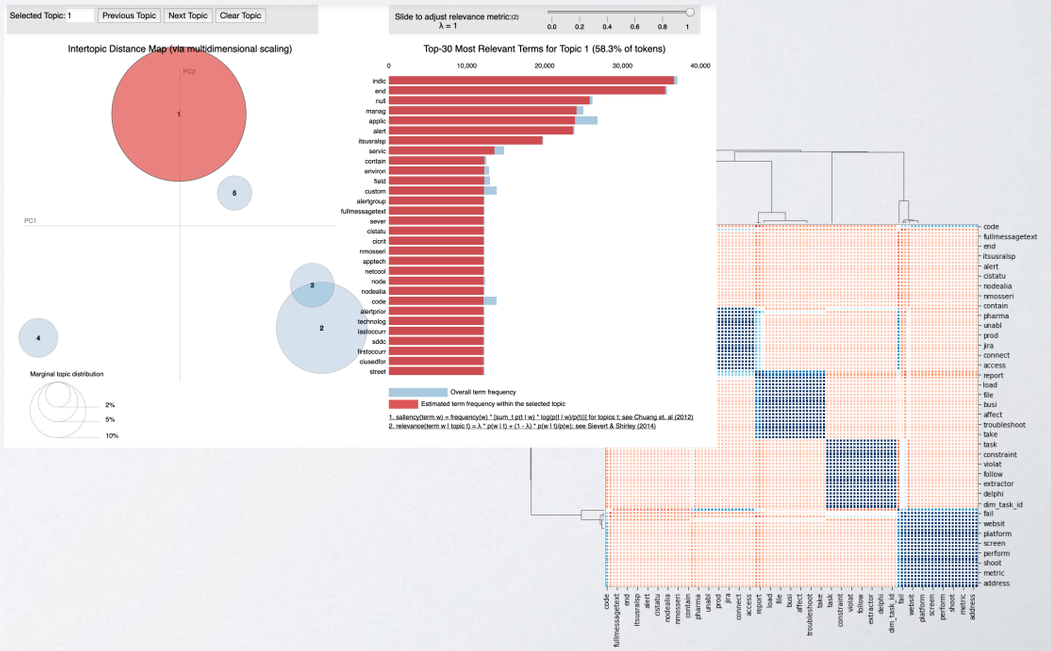
Data Issue	15233	
Job Failure	14386	
User Access / Permission	5666	5499
Security / Network password		167
User knowledge or training error	4559	
Incident Opened in Error / Not serviced	4277	3908
Cancelled by user		369
SOFTWARE	6440	
Configuration Error		3070
Software Incompatibility		139
Application Defect (SDLC activities)		1138
Change Implementation		940
Interface or Middleware		447
Software Bug (vendor)		225
Missing Patch		117
High Memory Utilization		364
HARDWARE	4189	
High CPU Usage		77
Connectivity		2726
Physical environmental failure		665
Capacity/ Disk Space		399
Supplies Low		87
SSO/Network		85
Broken/Damaged (physical)		79
Workstation Remediation		64
HD Encryption		4
Paper Jam		2
Virus/Malware		1
	54750	



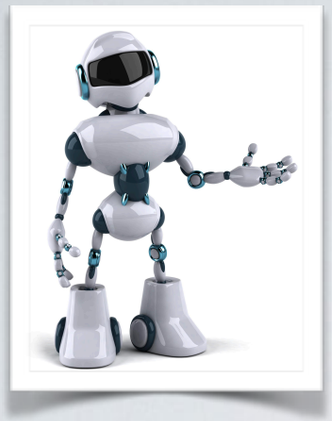
DATA PREPARATION AND ANALYSIS

- Removing any NAN observations
- Due to special characters created by automatic monitoring systems, we replaced the description with short_description
- Subsample data: Removing low freq. categories, and when possible balance the data
- 7 new Resolution Categories proposed based on the Clustering analysis
- Most of the descriptions are less than 20 characters which makes difficult not only for manual but automatic tools to determine correct categories



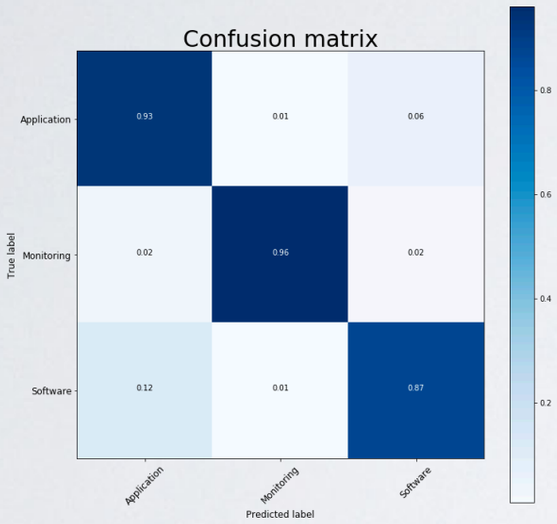


RESULTS

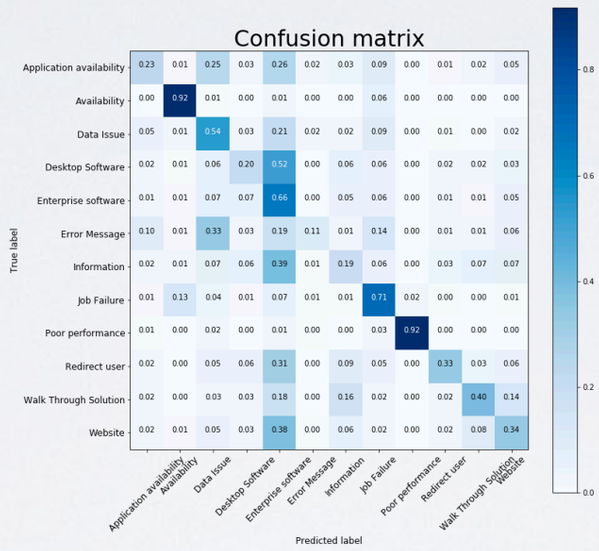


RESULTS OF THE NEURAL NETWORK **RNN** FOR INCIDENT CLASSIFICATION

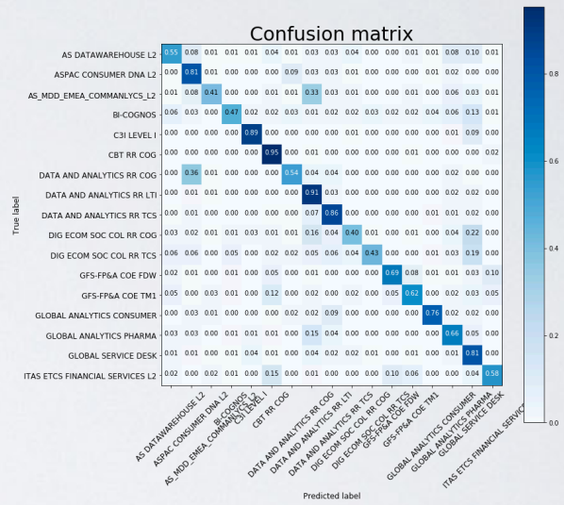
Category
Accuracy: 91%



Sub-Category
Accuracy: 74%



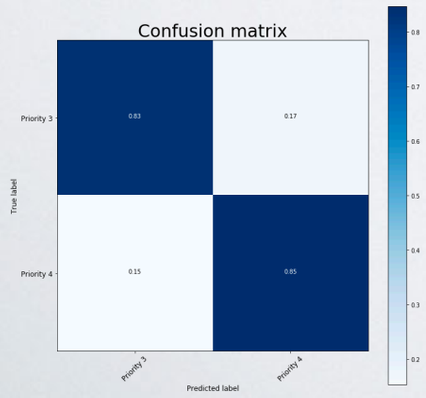
Resolved by Group
Accuracy: 80%



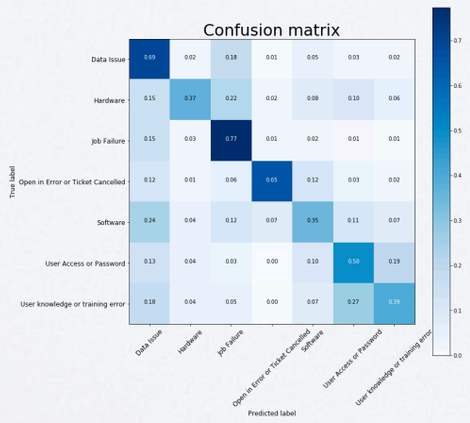
Manual
84%

Automatic
80%

Priority
Accuracy: 84%



Resolution Category: 7
Accuracy: 58%



Knowledge Article
Accuracy: 37%

DEPLOYMENT

- **Integration between ServiceNow and AWS** using the endpoint url triggered by the API Gateway through Rest web services and accessed it using javascript that runs on creation of ticket.

- **On creation of a ticket**, the javascript is triggered which **sends the incident description already tokenized/padded to the model** placed in AWS which performs the machine learning operations and **returns back the predicted categories and probability**.

- While the results are assessed by ITSM leadership, the model was deployed using **Flask** where the description is submitted and the model predicts each category with a probability.

- Demo

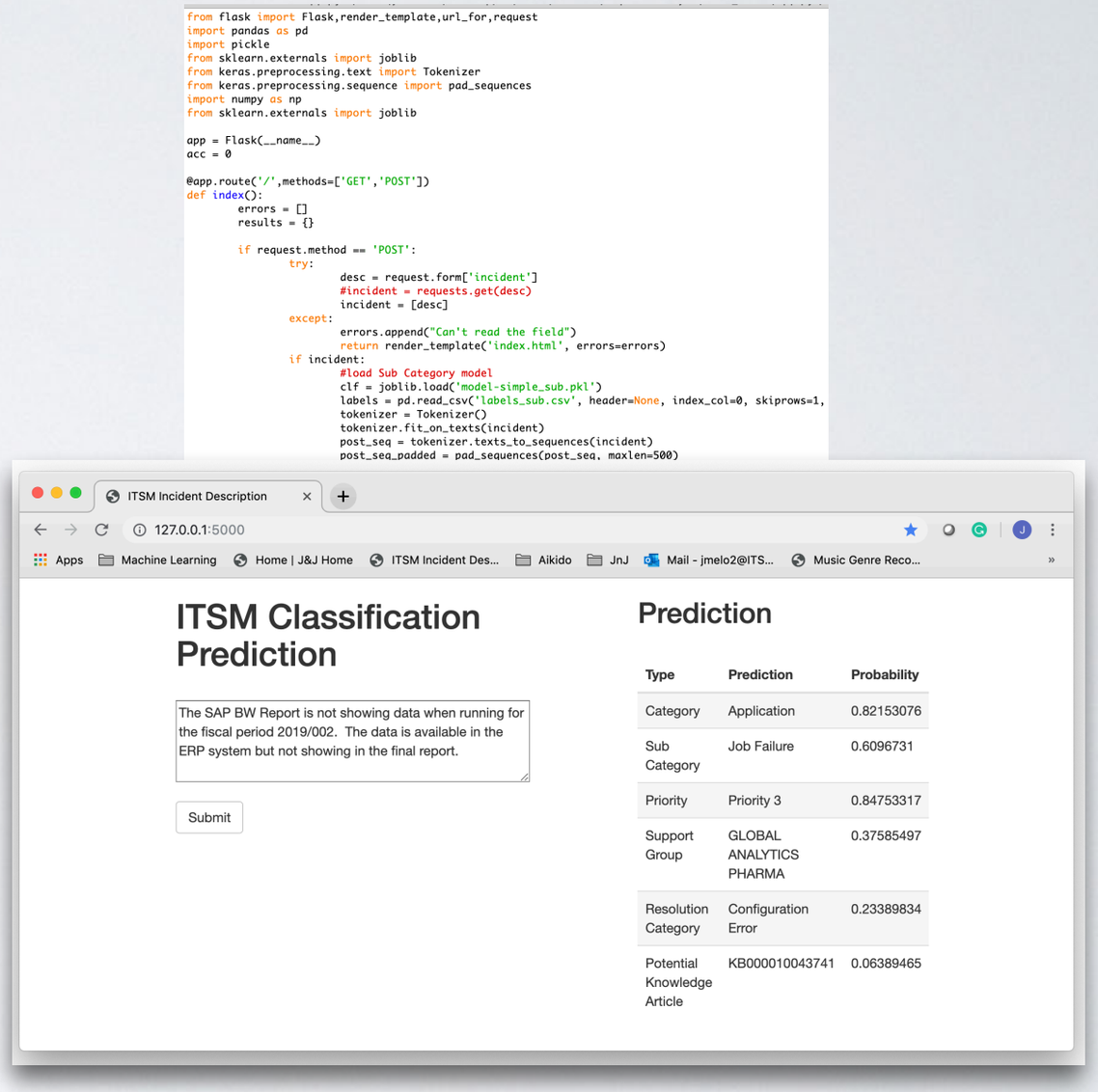
- https://github.com/JAIR0MEL0/ML1030-Capstone-Project

```python
from flask import Flask,render_template,url_for,request
import pandas as pd
import pickle
from sklearn.externals import joblib
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
import numpy as np
from sklearn.externals import joblib

app = Flask(__name__)
acc = 0

@app.route('/',methods=['GET','POST'])
def index():
        errors = []
        results = {}

        if request.method == 'POST':
                try:
                        desc = request.form['incident']
                        #incident = requests.get(desc)
                        incident = [desc]
                except:
                        errors.append("Can't read the field")
                        return render_template('index.html', errors=errors)
                if incident:
                        #load Sub Category model
                        clf = joblib.load('model-simple_sub.pkl')
                        labels = pd.read_csv('labels_sub.csv', header=None, index_col=0, skiprows=1,
                        tokenizer = Tokenizer()
                        tokenizer.fit_on_texts(incident)
                        post_seq = tokenizer.texts_to_sequences(incident)
                        post_seq_padded = pad_sequences(post_seq, maxlen=500)
```



CONCLUSIONS

- The deployment of this model is targeting the reduction of incorrect first time assignment and meantime resolution caused partly by miss routing or miss classification of the tickets which translate into customer satisfaction, better resource allocation and better preventive activities.
- First time assignment to improve using a Augmented Reality classification process where Service Desk team will Focus on Tickets classified with less than 80% of accuracy.
- ITSM management identified a need to reinforce with the Helpdesk team to improve the descriptions with more relevant information
- The usage of the Word count distribution across time and LDA and correlation matrix will be used as metrics by TS Management
- Automatic process fill the description with parameters with no relevant data
- Resampling the data it reduces the unbalance data but increases the bias. Reclassification of the categories was approved by stakeholders
- A general RNN model without LSTM provided us the accuracy of 58% whereas LSTM network layer in RNN didn't really improve and it could be related to the data.
- This represents the first step on the way towards a fully automated, future-proof end-to-end ticket processing pipeline, especially when considering integrating these solutions with chatbot front-ends for automatic ticket data collection at the start of the process and with ML-enabled automatic ticket solution capabilities towards its end. This way, both a truly scalable 24/7 ITSM solution capable of dealing with the ticket volumes looming in the near future can be obtained and IT resources are freed up for more valuable and rewarding activities such as issue resolution and request fulfillment.
- Yet 58% was accepted resolution classification as I intend to train it online and continuously improve the accuracy as volume of data grows to