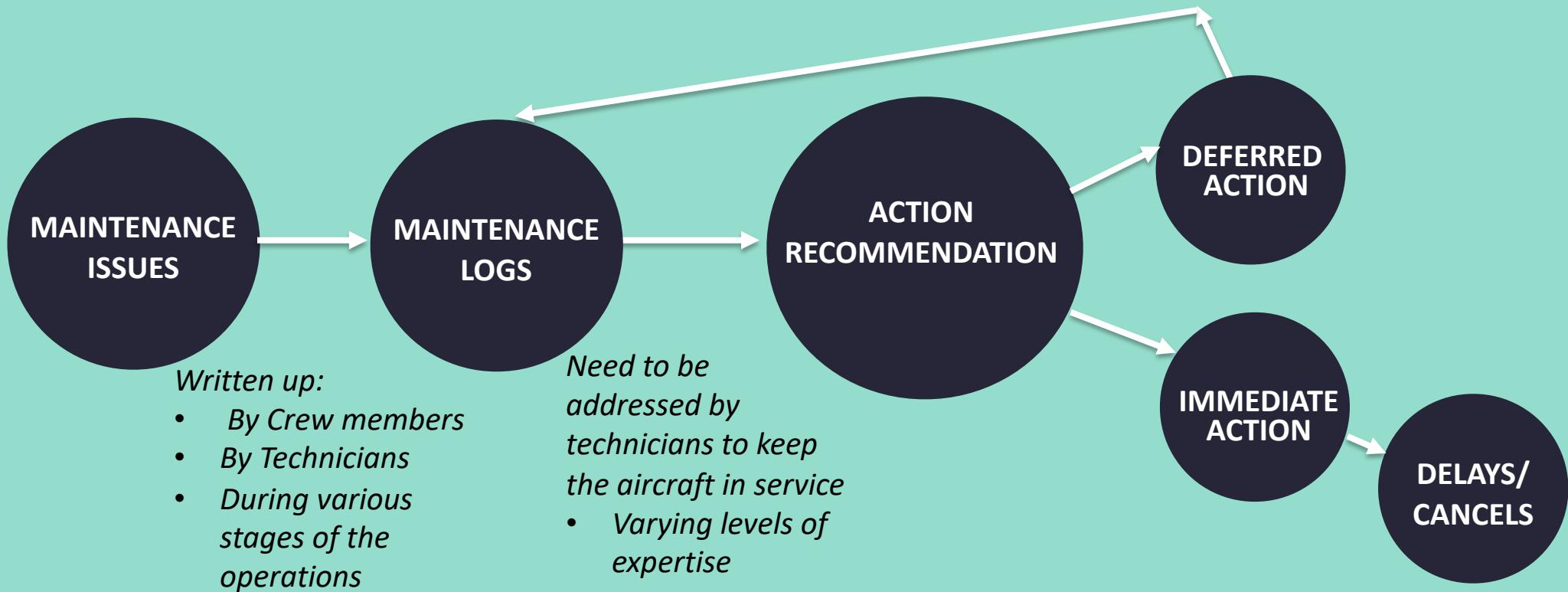




NLP Modeling for Aircraft Maintenance

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Context



Process for troubleshooting maintenance logs is very manual, time-consuming, and prone to human errors

Problem Statement

Build a Machine Learning model to:

- Read maintenance logs
- Convert them to machine-readable language using NLP techniques
- Predict an action based on historical data

Benefits

- Speed up the maintenance process
- Reduce human errors
- Reduce airline delays & cancellations

Example: Original Text

problem_log	corrective_action	ata4_desc
<p>CREW REPORTED RUBBER SMELL IN CABIN FROM ROWS 1 TO ROWS 21. NEWMAN TOMC. SAMC TEXT: WO#15092916. CREW ALSO REPORTED THAT SMELL HAD QUICKLY DISAPATED. NEWMAN TOMC.</p>	<p>:NO DEFECTS NOTED IN GALLEY EQUIP, CABIN EQUIP, AEVC EQUIP AND AIR COND EQUIP PER TSM 05-51-00. FOLLOWED TSM 21-00-00-810-801 PERFORMED ENG AND APU RUNS AND NO BU RNT RUBBER SMELL PRESENT. NEWMAN TOMC. - OPBLM NEWMAN JAY</p>	PASSENGER COMPARTMENT
<p>LOUD CHATTER AND VIBRATION HEARD AND FELT IN AC.</p>	<p>:RESET VALVE IN WATER LINE BEHIND COFFEE MAKER AFT GALLEY. NOISE STOPPED.</p>	GALLEYS
<p>29DEC MFE DF -Q :AFT AFT LAV TRASH DOOR FLAPPER SPRING IS BROKEN. NEWMAN TOMC. SAMC TEXT: WO# 15122914.</p>	<p>:DEFERRED PER MEL. TAPE OVER FLAP PER DOOR AND INSTALLED DF-CF PLACARD ON FLAPPER AND LOCKED OUT LAV DOOR. NEWMAN TOMC.</p>	EQUIPMENT FURNISHINGS GENERAL

Airline has classified logs into broad descriptions using historical relationship between logs & actions; objective here is to build a model to predict action

Problem Log

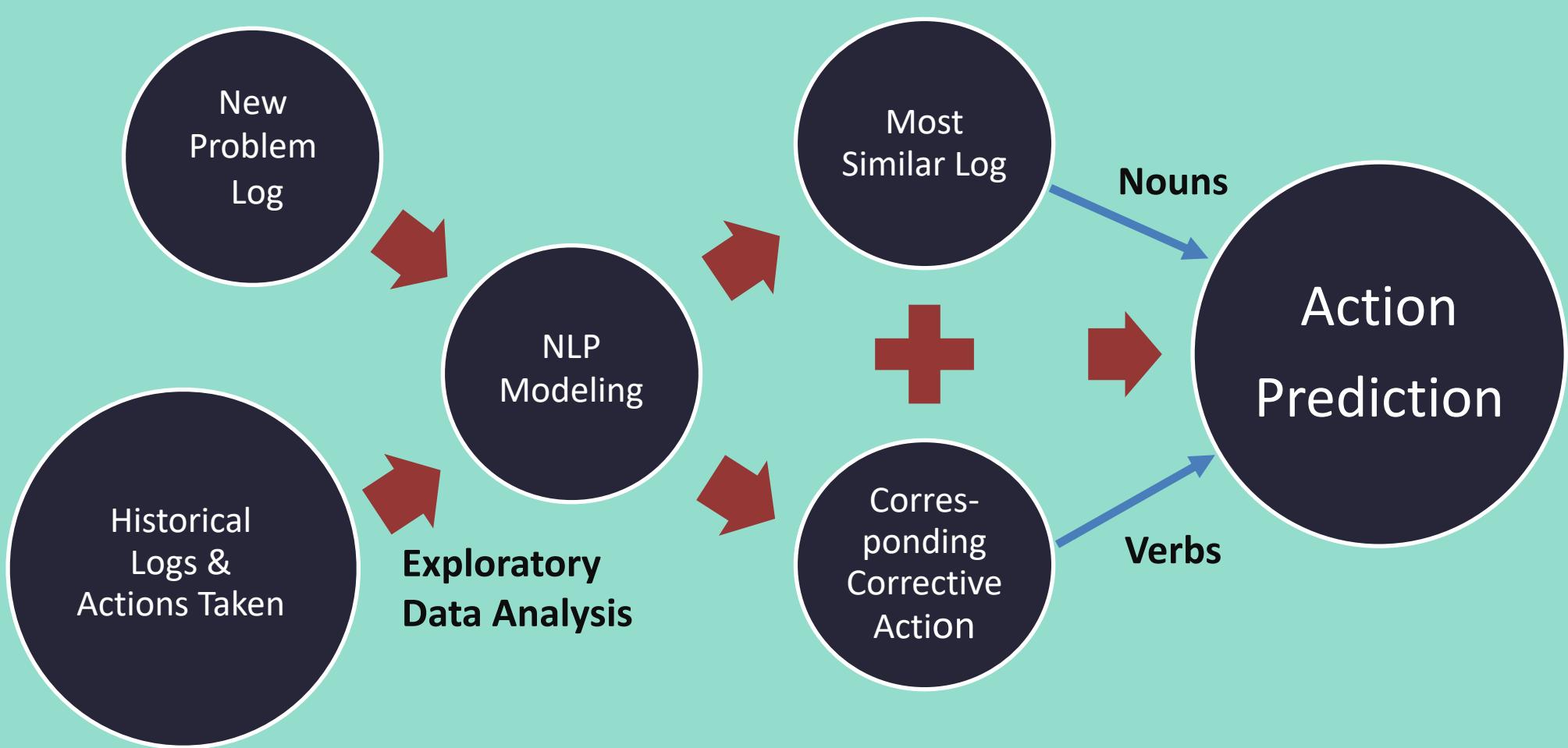
(More Nouns)

Corrective Action

(More Verbs)



Model Workflow



Use Cosine Similarity to match text, and SpaCy part-of-speech tagging to identify nouns and verbs

Using Cosine Similarity

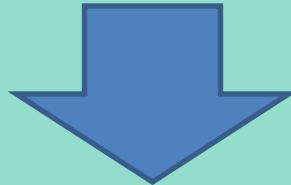
PROBLEM LOG: [coffee maker 812 flowing constantly]

problem_log	cos_similarity	corrective_action
coffee maker 812 flowing constantly	1.000000	removed and replaced coffee maker 812 ops and leak check ok rotatable parts change was indicated tt 1431005 sn off 06210coffeemaker a off 78 2500 9 9001 6210 on 78 2500 9 9001 9805
fwd coffee maker will not stop brewing water is constantly coming out	0.853548	removed and replaced coffeemaker at position 212ops check normalrotatable parts change was indicated tt 1465458 sn off 0688coffeemaker in off 31 2534 9 0001 0688 on 31 2534 9 0001 0010
coffee maker 509 mid galley constantly overflows water	0.841361	rotatable parts change was indicated tt 1673152 sn off 07610coffeemaker a off 78 2500 9 9001 7610 on 78 2500 9 9001 3907

Identify historical log with highest cosine similarity and find corresponding action

Using SpaCy Part of Speech Tagging

PROBLEM LOG	NOUNS and VERBS
coffee maker 812 flowing constantly	Noun phrases: ['coffee maker'] Verbs: ['flow']



CORRECTIVE ACTION	NOUNS and VERBS
removed and replaced coffee maker 812 ops and leak check ok rotatable parts change was indicated tt 1431005 sn off	Noun phrases: ['coffee maker'] Verbs: ['remove', 'replace', 'be', 'indicate']

Examples of Predictions

Problem Log	Cosine Similarity	Action Prediction
'SEAT 27C NEEDS NEW SEAT CUSHION COVER'	0.93	'replace', 'seat', 'new cushion', 'cover'
'COFFEE MAKER 420 WILL NOT SHUTOFF.'	0.91	'remove', 'replace', 'work', 'ok', 'be', 'indicate', 'coffee maker'
AFT GALLEY COFFEE MAKER LEAKING.ENTERED INTO SCEPTRE FOR EMPLOYEE #0080038.'	0.74	'perform', 'check', 'galley coffeemaker leaking note', 'sceptre', 'flight crew employee'
'FIRST OFFICERS OXYGEN MASK HARNESS WILL NOT INFLATE'	0.71	'straighten', 'first officers seat belt buckle', 'shoulder harness'

*Corrective action text is has many more words than problem logs, needs more parsing

Next Steps

- Classify actions into deferred and immediate
- Create a corpus of tech words
- Continue to enhance NLP model to:
 - Better model time & numerical data
 - Identify specific topics
 - Investigate logic for selecting best nouns and verbs