
H2O
WORLD
2017

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Predicting and Preventing Avoidable Truck Rolls (ATR)

Comcast Applied AI Group

Comcast Applied Artificial Intelligence Group

Media & Video Analytics

Machine Learning & Data Science

Voice & NLP

Recommendations & Search

- Smart TV
- Smart Home
- Smart Internet
- Customer Service
- Operations
- …

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Machine Learning for the Smart TV Voice Interface

Every X1 Customer can get a free voice remote at
http://www.xfinity.com/voice-remote

1

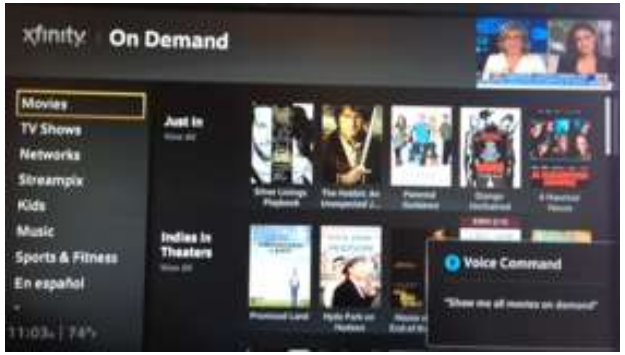
NLP IN THE CLOUD

2 SPEECH-TO-TEXT

3 INTENT UNDERSTANDING

4 ACTION RESOLUTION

5 MESSAGE MANAGEMENT



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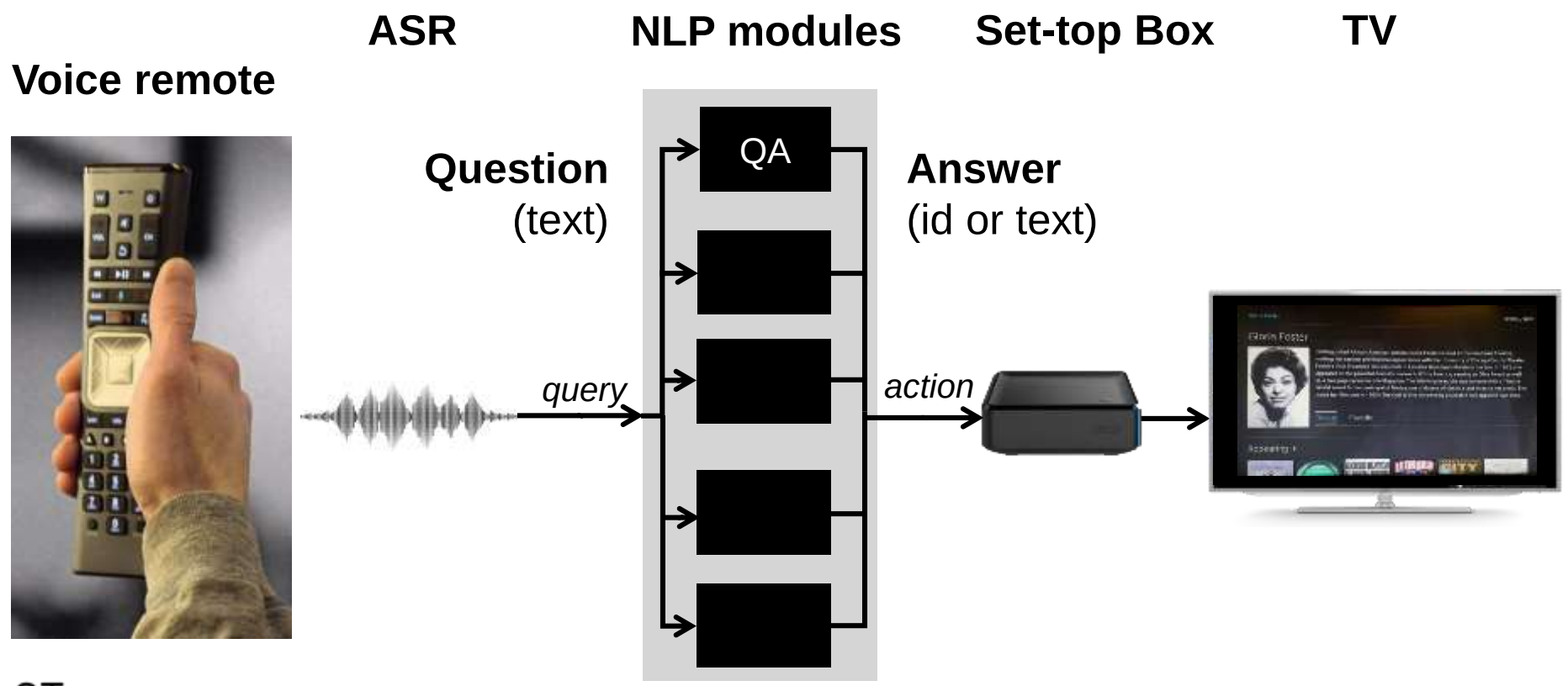
X1 Smart TV with Voice

Query: “who plays the oracle in the matrix”



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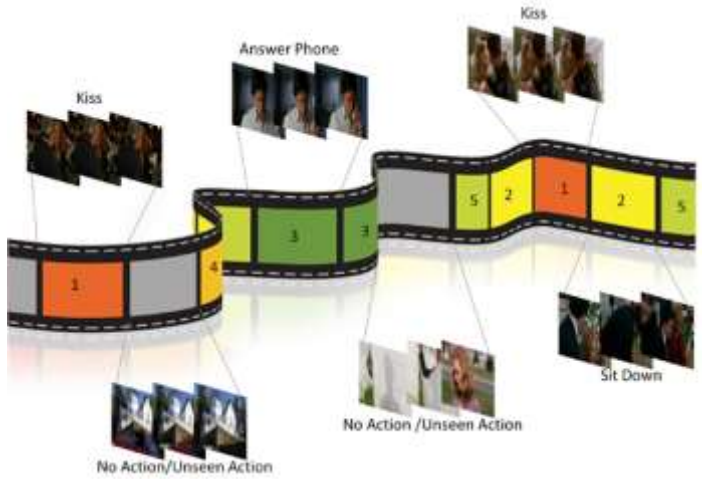
ML for the Smart TV Automatic Content Analysis

Most metadata is at the asset level

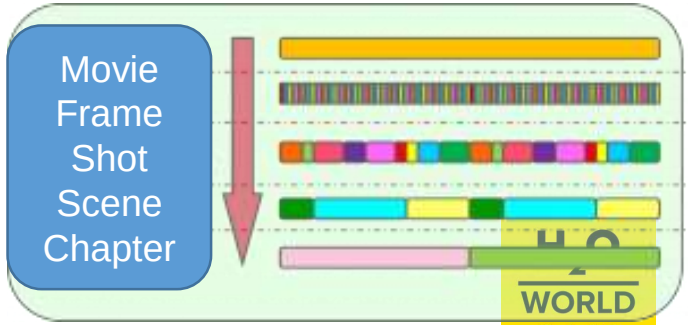
- Genres
- Credits
- Synopsis
- Keywords



Much mode data Within the asset

- Chapters
- Moments
- Annotations

Movie
Frame
Shot
Scene
Chapter



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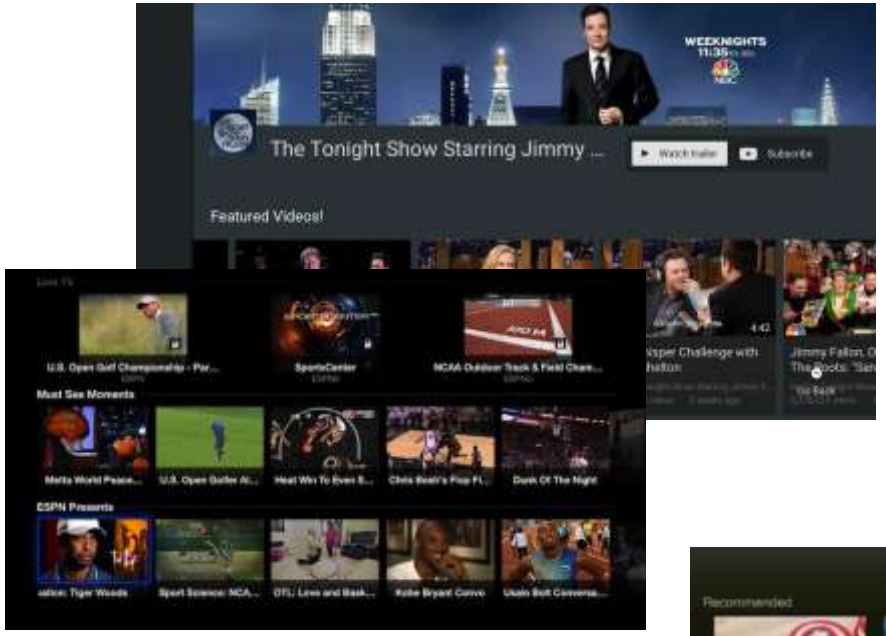
Why is this useful?

What are the best moments on TV?



In-game highlight navigation

Who is in this scene?

Search & Recommendations

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ML Smart TV Personalization Experience

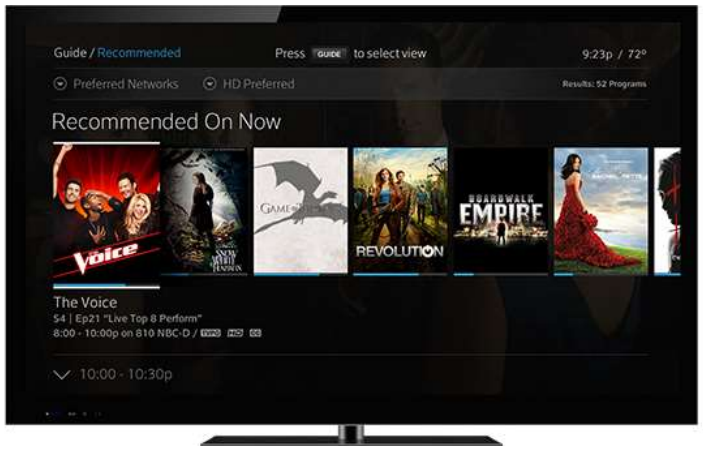
What do you like?

+

What is popular right now?

=

Personalized Recommendations



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Predicting and Preventing (ATR)

Media & Video Analytics

Machine Learning & Data Science

Voice & NLP

Recommendations & Search

Smart TV

Smart Home

Smart Internet

Customer Service

Operations

…

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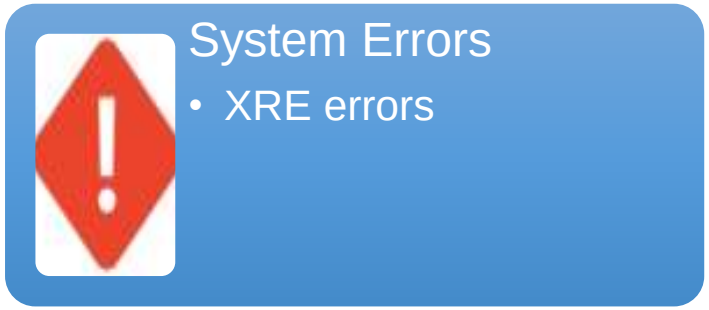
Customer Care + AI

Additional data sources: several GB/day



Device errors
Operations mgt
Diagnostic and NW mgt tools

Goal
Better customer Experience

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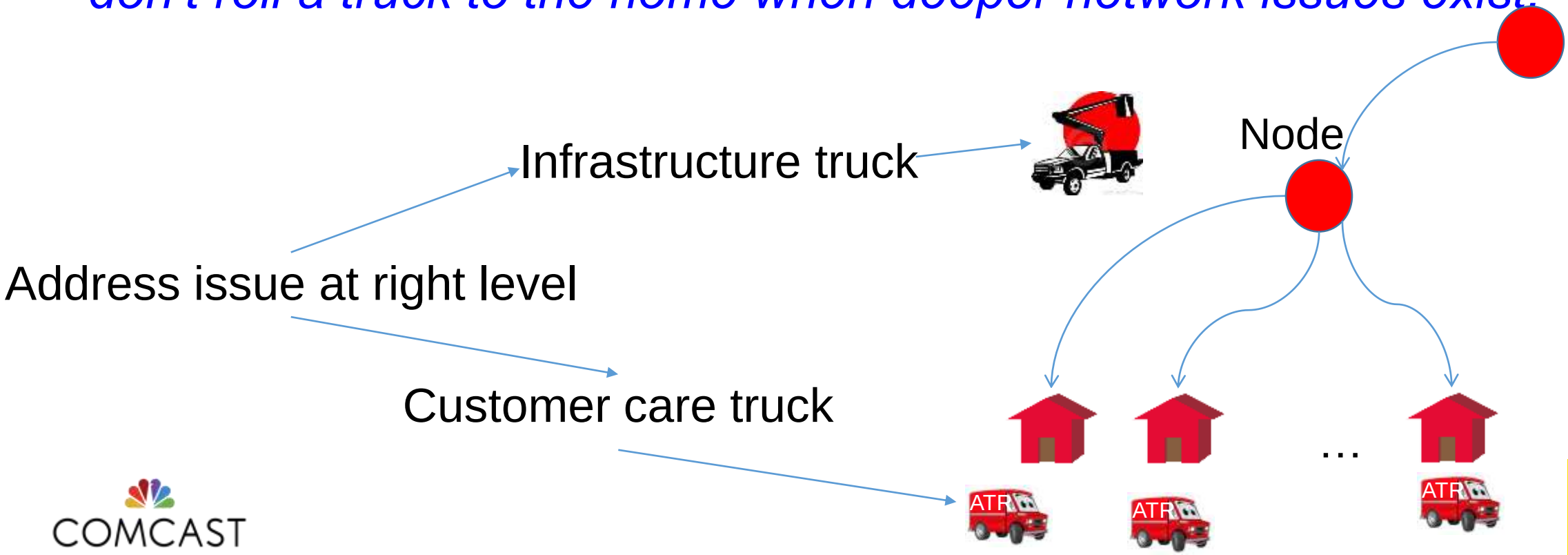
Avoidable Truck Roll (ATR)

Problem

Predict and prevent ATRs

don't roll a truck to the home when deeper network issues exist.



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ATR and Customer Experience

ATR

A large percentage of customer issues for which truck rolls are ordered end up being unnecessary

Better customer experience

Reducing truck rolls increases customer experience and improves NW service reliability

Lack of insight

Into what's triggering excessive truck rolls. Service departments struggle to reduce truck rolls because they don't understand the root causes and how to address them

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First Model
Nov 28 2016

Truck Roll info + NW health

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Following the Truck Roll Flow

Customer calls

Call (IVR)

Biller system maps Customer dwelling

Biller System

DwellType
CustReq
ReasonDesc

Truck Roll

Biller System

Technician Assessment

ATR
= {intermittent problem ||no problem found || ok on arrival ||
tv-replace cpe-no problem found ||xhs-no problem found}

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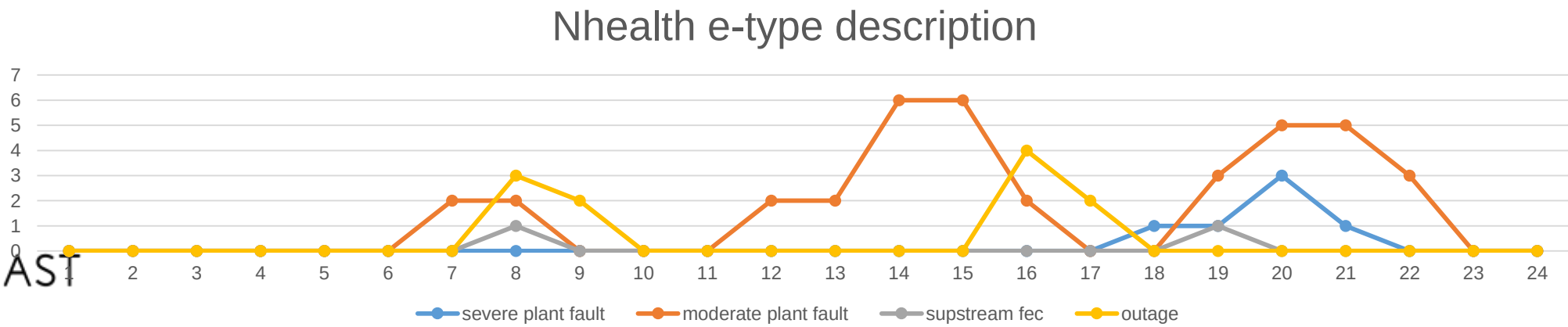
Assessing Network Health

NW Health issues Node status messages

Assessing NW health

nhealth_etypedesc, e.g. moderate plant fault, upstream fec, severe plant fault, outage, …
nhealth_etype,
nhealth_stateid,
nhealth_devicetype

These messages are represented in Time-Series



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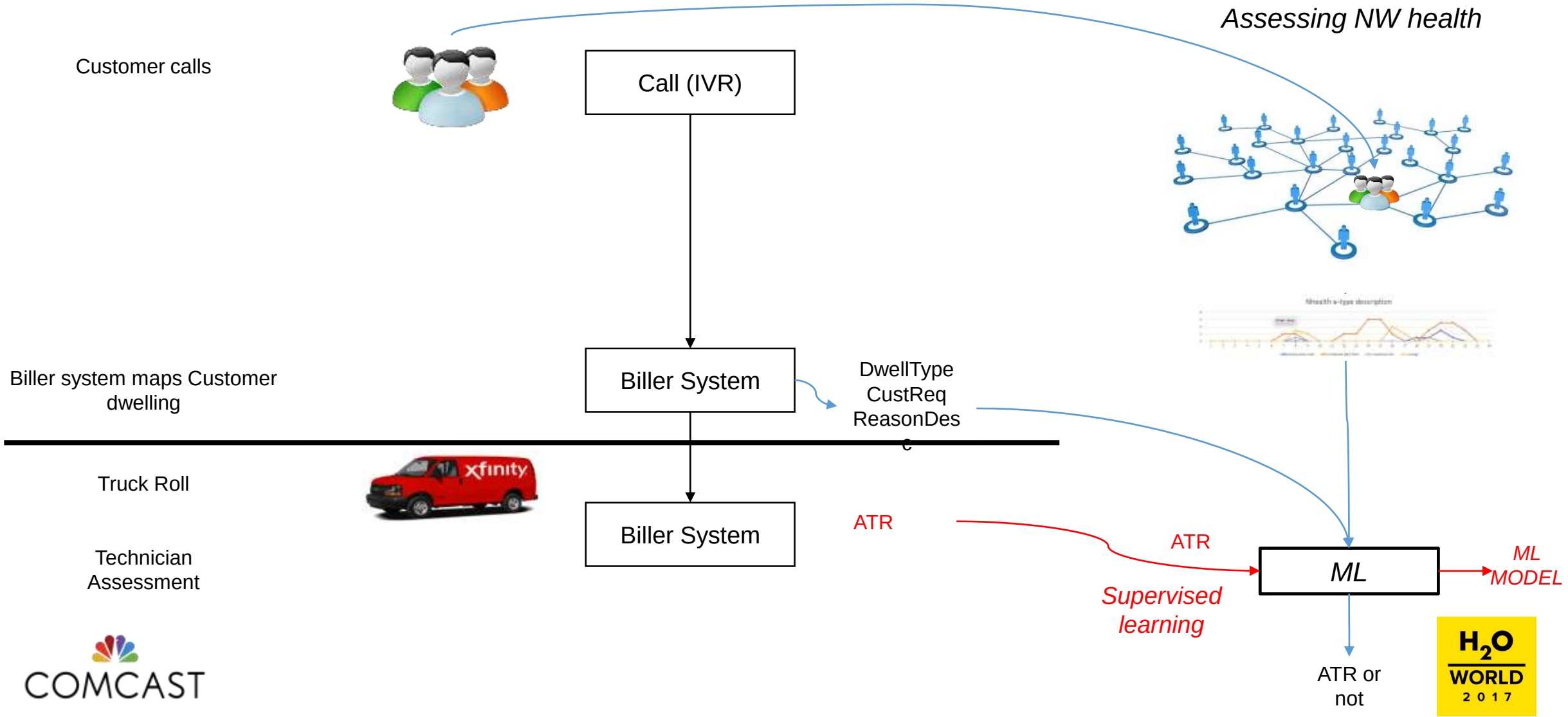
Our Approach to Predict Avoidable Truck Rolls

LEARNING PHASE



Our Approach to Predict Avoidable Truck Rolls

PREDICTION PHASE

Customer calls

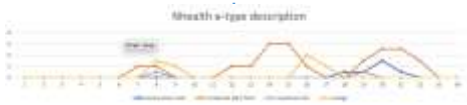
Call (IVR)

Biller system maps Customer dwelling

Biller System

DwellType
CustReq
ReasonDesc

Assessing NW health



TRAINED ML MODEL

ML

ATR or not

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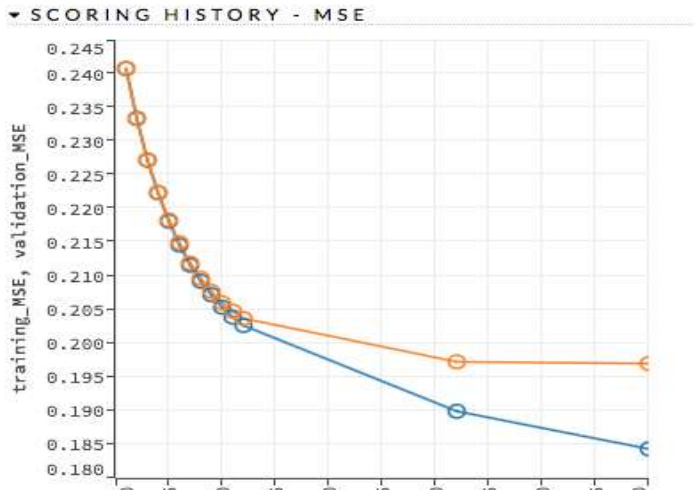
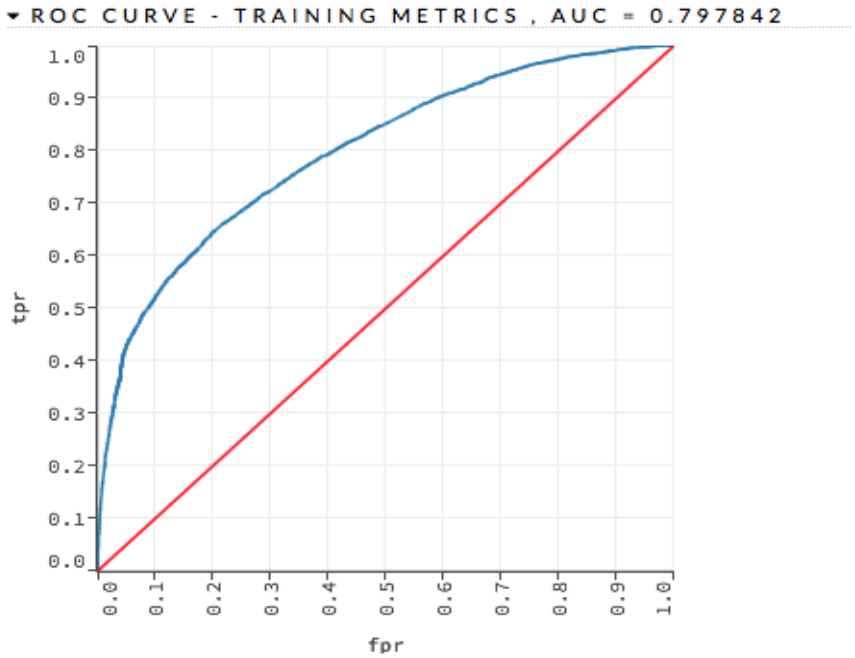
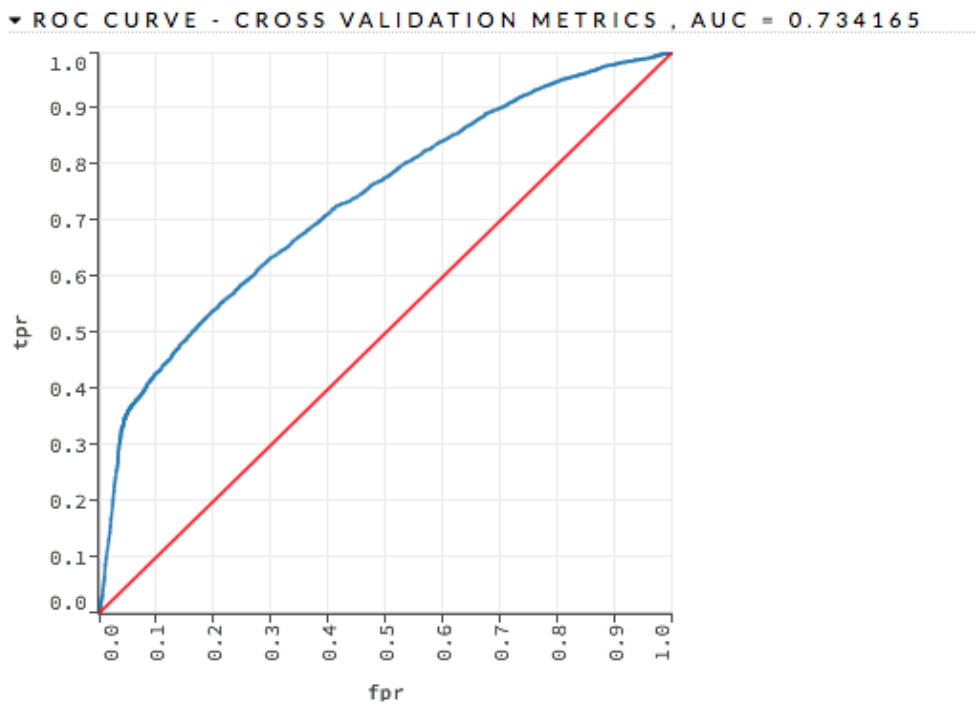
Simulation Results: 67% accuracy



metric	*threshold*	*value*	*idx*
max f1	0.3377	0.6943	286
max f2	0.0712	0.8337	396
max f0point5	0.5790	0.6879	136
max accuracy	0.5079	0.6700	172
max precision	0.8617	0.8947	44
max absolute_MCC	0.7054	0.3829	89
max min_per_class_accuracy	0.4403	0.6617	214





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Second Model
Dec 2 2016

1st Model + Addition of NW Topology

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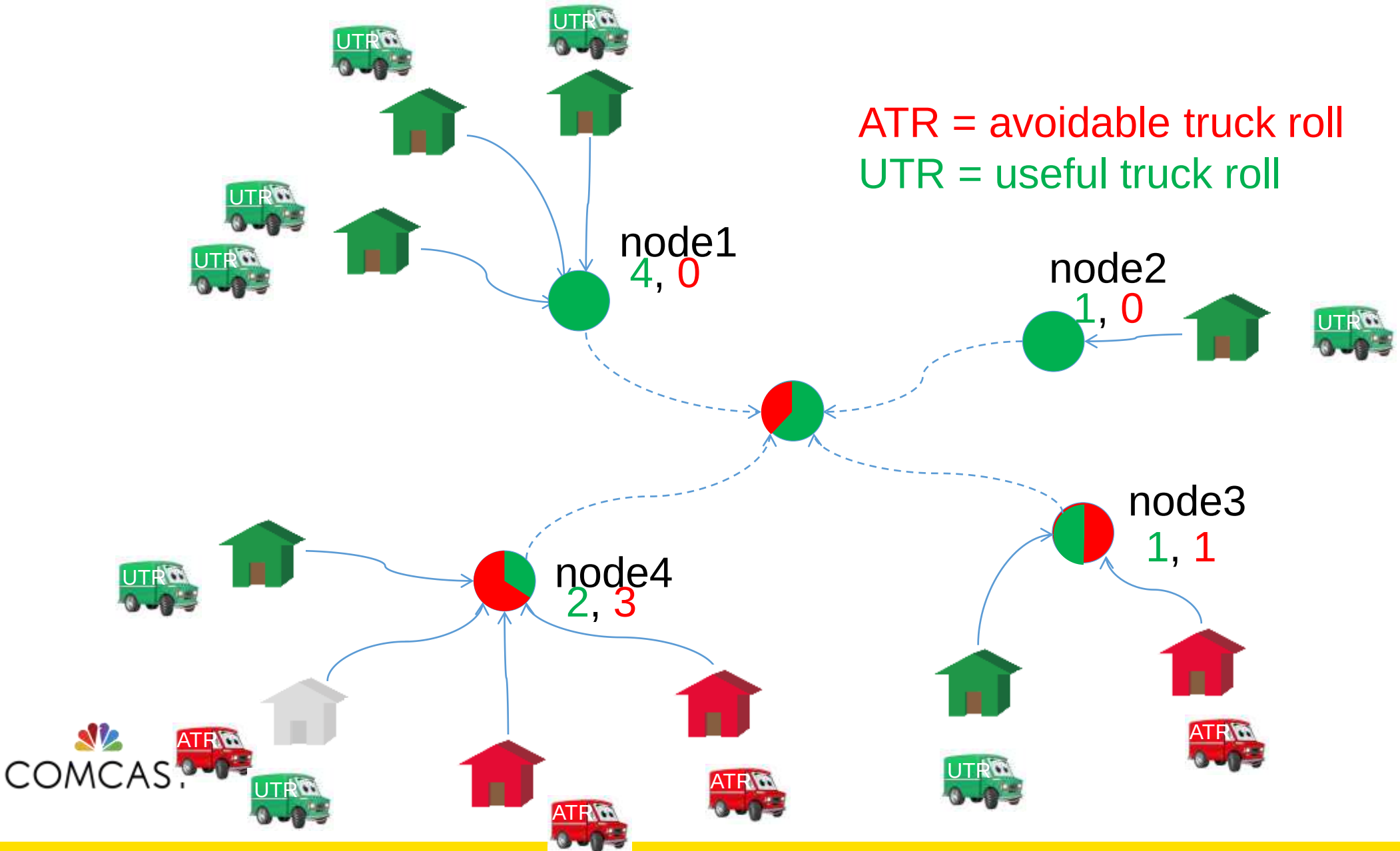
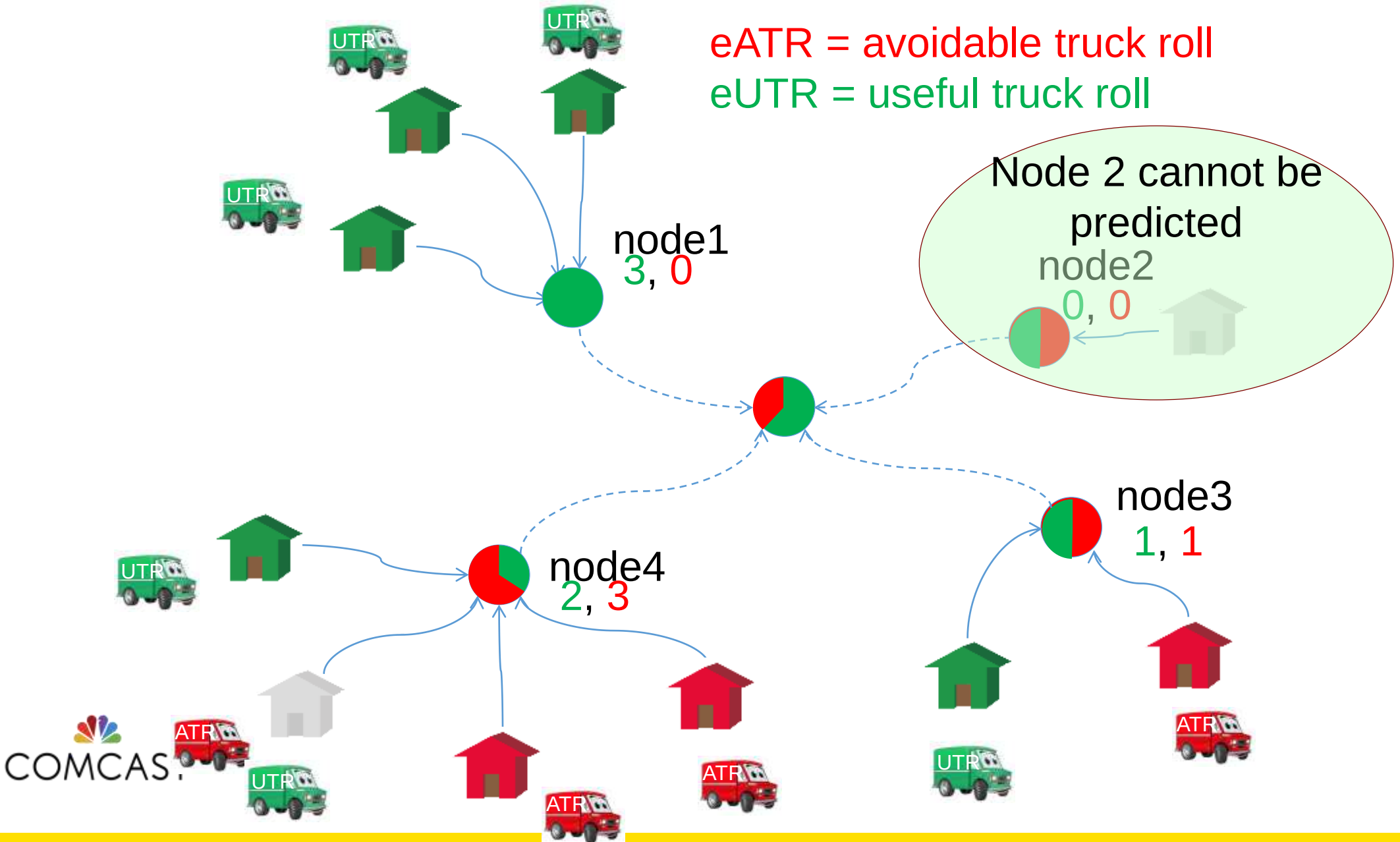
Addition of Neighborhood Topology



Estimating the Neighborhood Topology in Real-Time



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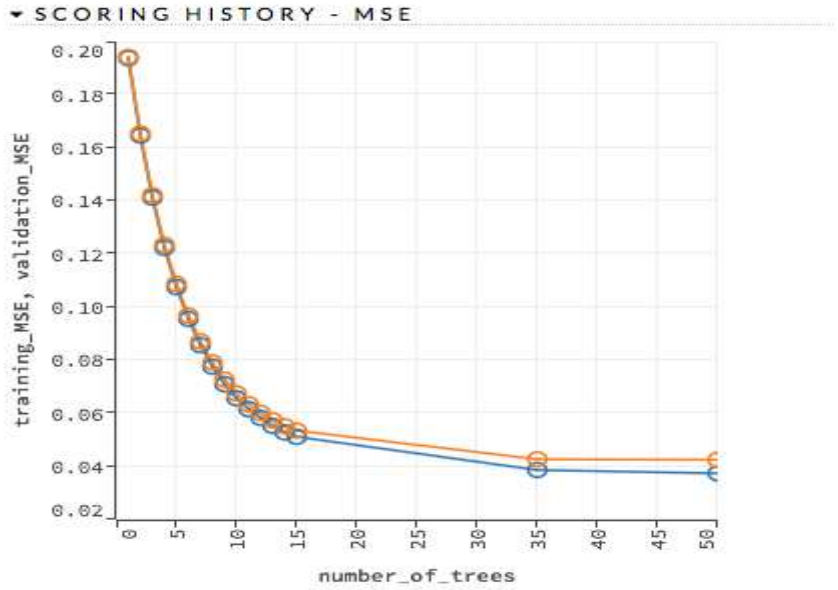
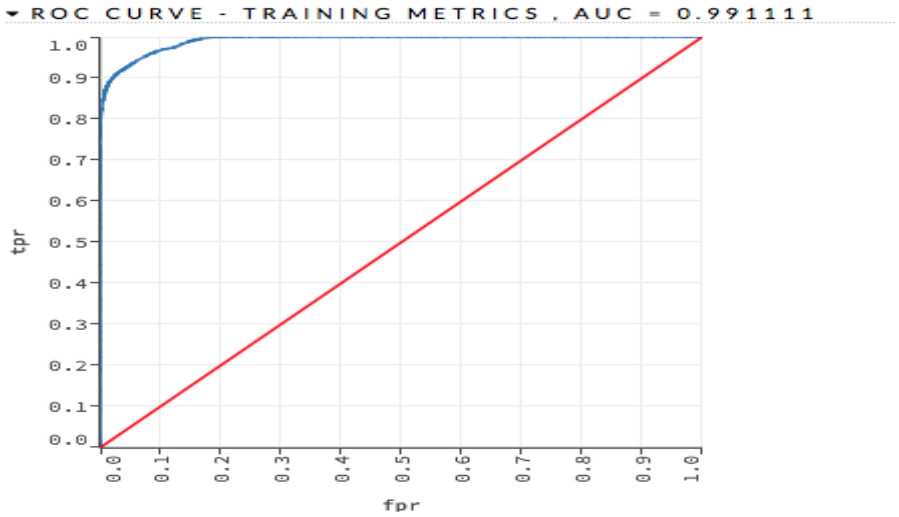
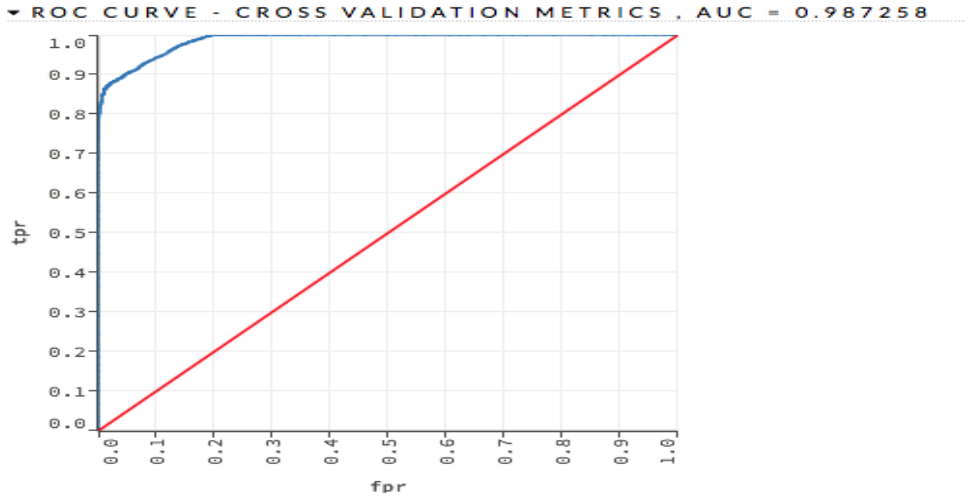
Simulation Results: 93% Accuracy



metric	threshold	value	idx
max f1	0.4828	0.9490	265
max f2	0.1467	0.9783	320
max f0point5	0.8424	0.9639	110
max accuracy	0.5106	0.9325	254
max precision	0.9922	1.0	0
max absolute_MCC	0.4828	0.8536	265
max min_per_class_accuracy	0.5964	0.9242	209





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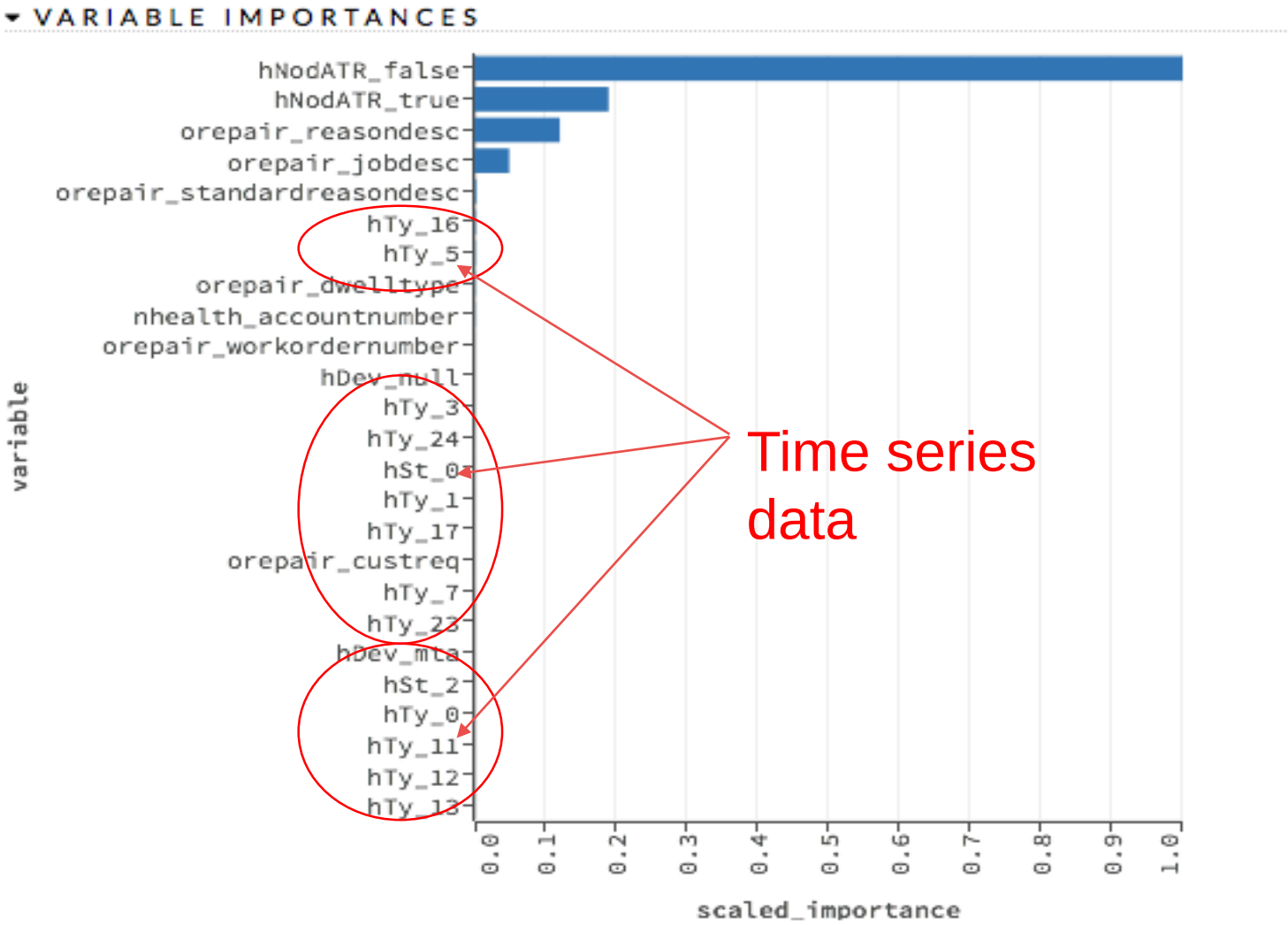
Modest Contribution of Time Series



Not worth the hassle

Drop them
In next model

and replace them by NW features

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Third Model
May 15 2017

Extended definition of ATR
In depth revisited model
No more time series

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Following the Call Center Flow

Customer calls

Call (IVR)

Agent follows Interactive Trouble shooting Guide

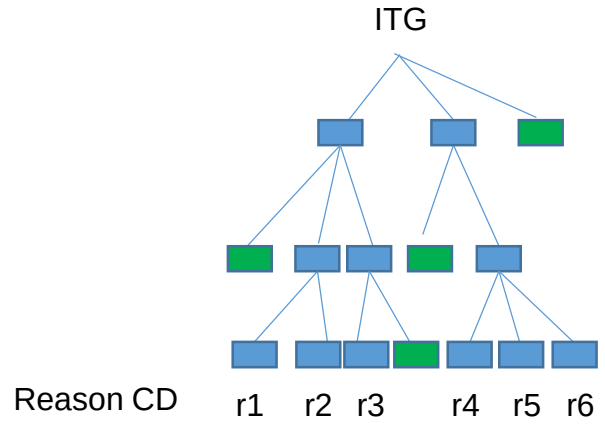
ITG (Ref. Guide) → Reason CD

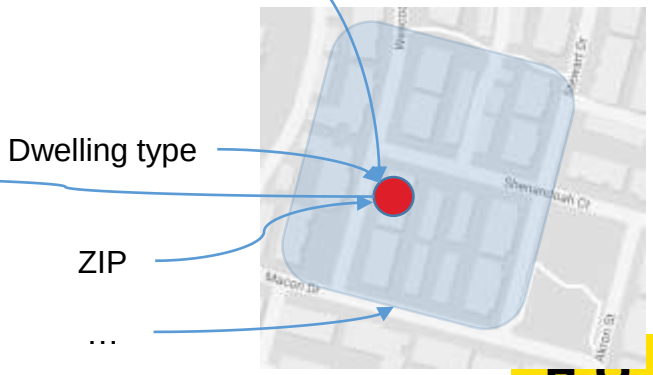
Failure, create Ticket

Trouble Call

Biller system maps ReasonCD to Customer dwelling, ZIP, …

Biller System → JobType, ZIP





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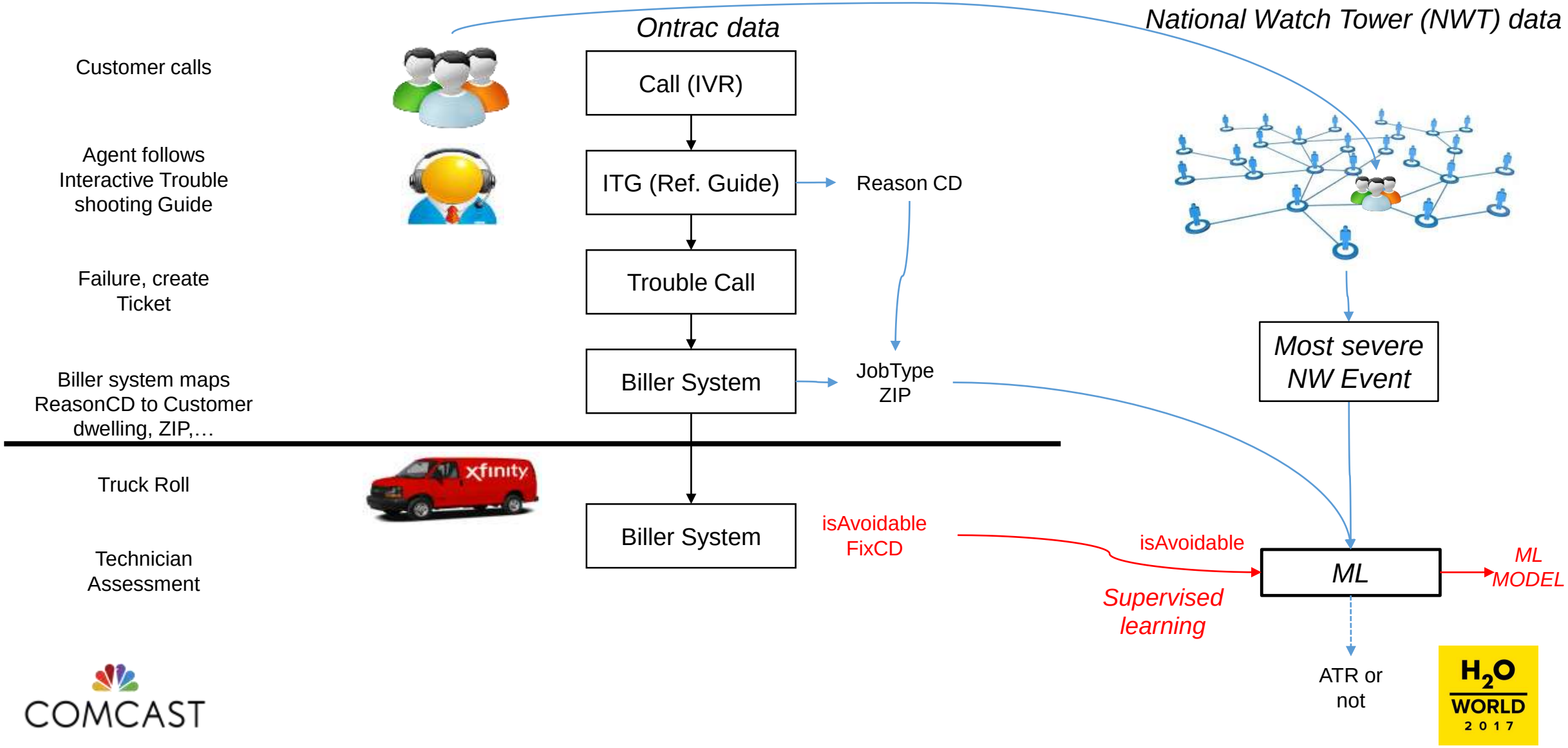
Our Approach to Predict Avoidable Truck Rolls

LEARNING PHASE



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Our Approach to Predict Avoidable Truck Rolls

PREDICTION PHASE

Customer calls

Agent follows Interactive Trouble shooting Guide

Failure, create Ticket

Biller system maps ReasonCD to Customer dwelling, ZIP, …

Ontrac data

Call (IVR)

ITG (Ref. Guide) → Reason CD

Trouble Call

Biller System → JobType ZIP

National Watch Tower (NWT) data

Most severe NW Event

TRAINED ML MODEL → *ML*

ATR or not

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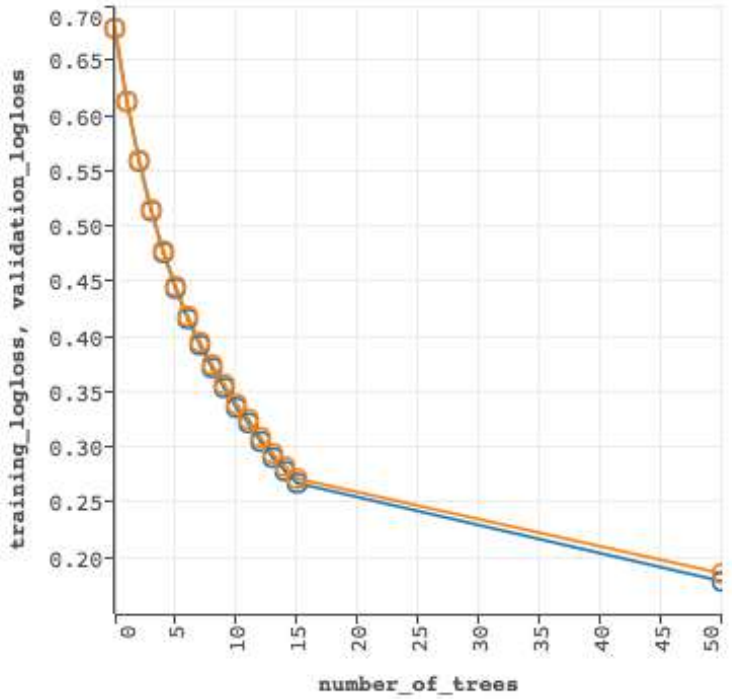
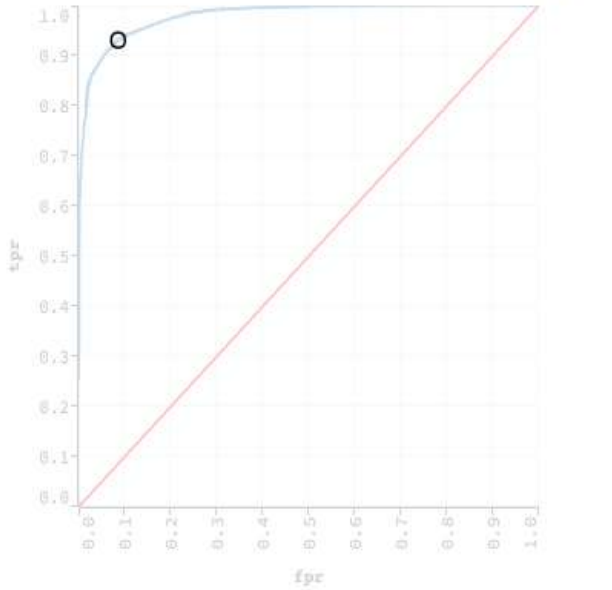
Simulation Results: 92% Accuracy





Threshold: 0.5184915453517093 **Criterion:** max accuracy

Selected mark(s):

threshold	0.5185
f1	0.9344
f2	0.9323
f0point5	0.9366
accuracy	0.9239
precision	0.9380
recall	0.9310
specificity	0.9140
absolute_mcc	0.8438
min_per_class_accuracy	0.9140
mean_per_class_accuracy	0.9225
tns	11302
fns	1192
fps	1063
tps	16072
tnr	0.9140
fnr	0.0690
fpr	0.0860
tpr	0.9310
idx	185

CM

Actual/Predicted	N	Y	Error	Rate
N	11302	1063	0.0860	1063 / 12365
Y	1192	16072	0.0690	1192 / 17264
Total	**12494**	**17135**	**0.0761**	**2255 / 29629**

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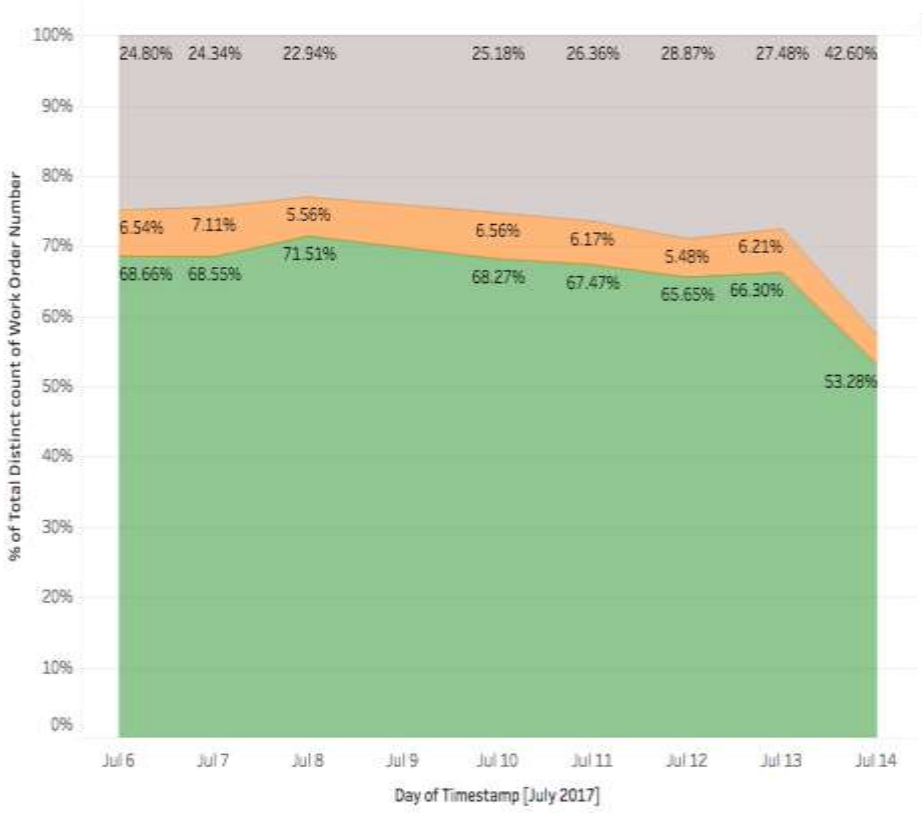
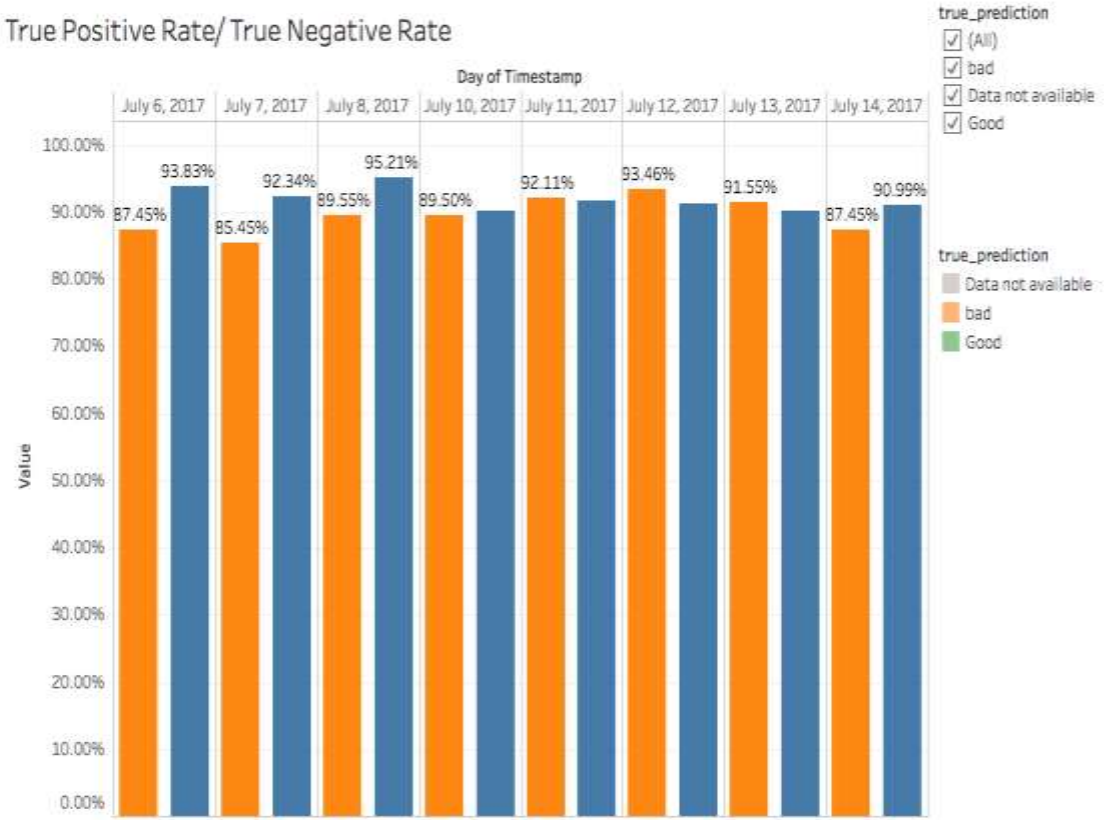
Initial Deployment Results: 90% Accuracy
(when available)





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Conclusion

Good proof of concept on ATR detection

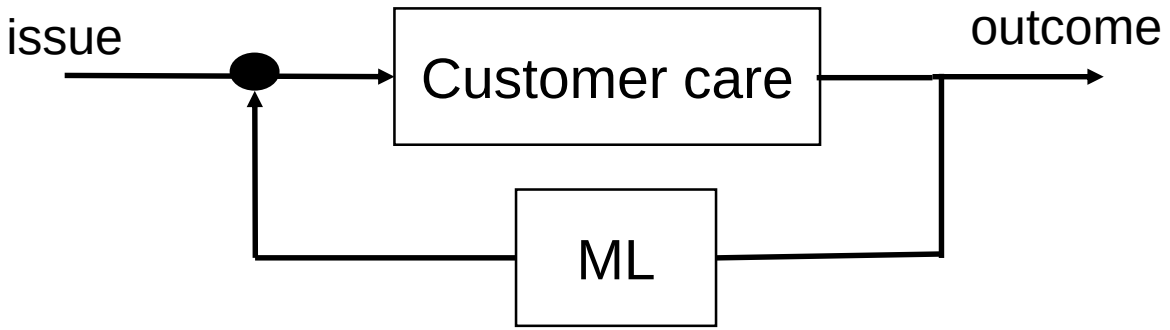
Limitation of the method

This method only works once the customer has placed a call

The method needs more investigation to define the root cause of the ATR

A proactive method preempting calls will have more impact on customer experience

We enter in a new era of customer care by developing a method based on Reinforcement Learning



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