WOMEN IN DATA SCIENCE
MYSURU

ML implementations on VoIP

ALTANAI BISHT

Sep 26th

# hello, I am Altanai

10 yrs in Telecom + Voice Over IP + Media streaming + Communication as a Service

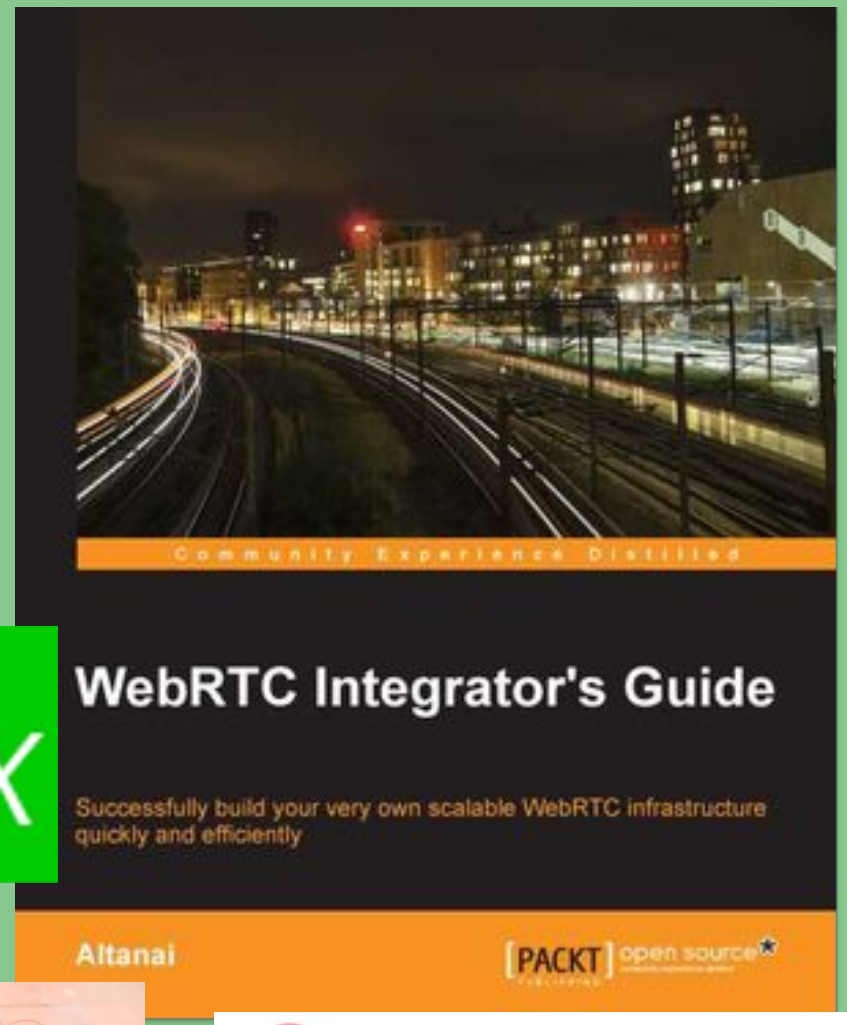
FreeLancer , Open source contributor and blogger

https://telecom.altanai.com/

Author of WebRTC Integrator's Guide

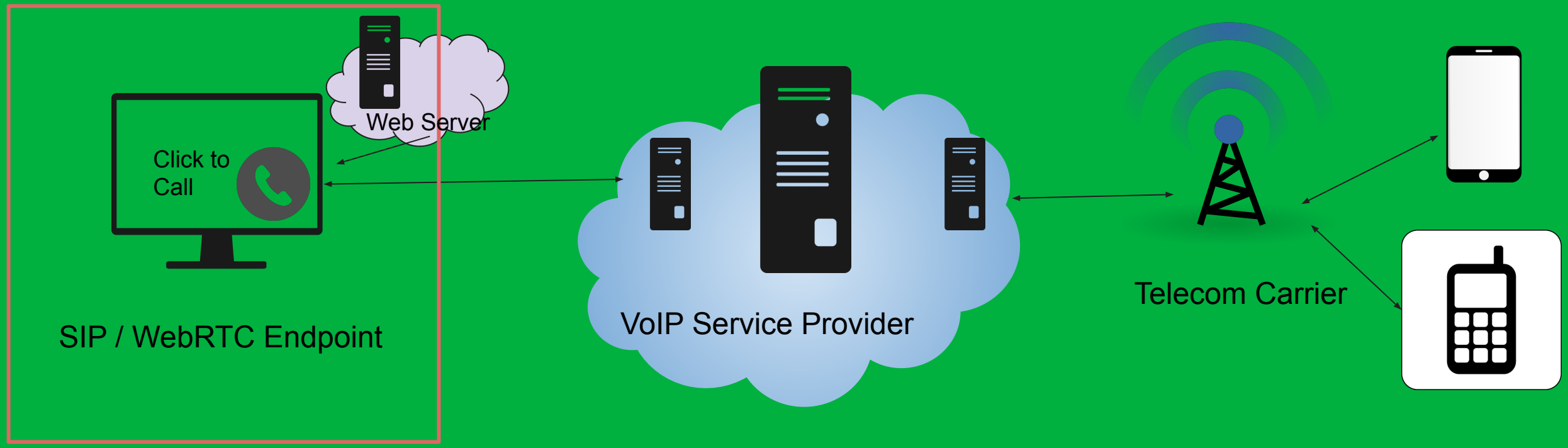
Inventor of RamuDroid ( Bot to clean roads and outdoors )

currently with @Airtel

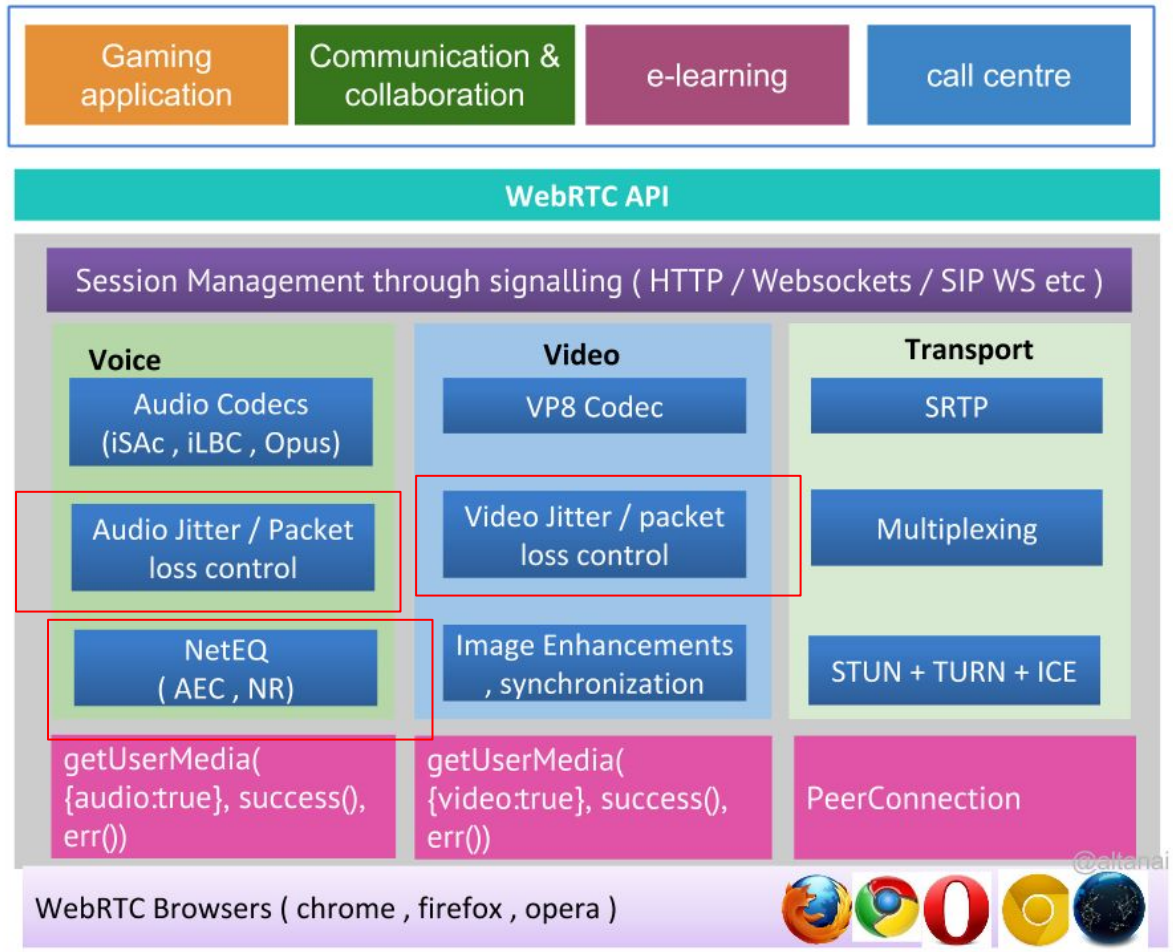




# Usual Scenarios ..



# Machine Learning in Media Streams



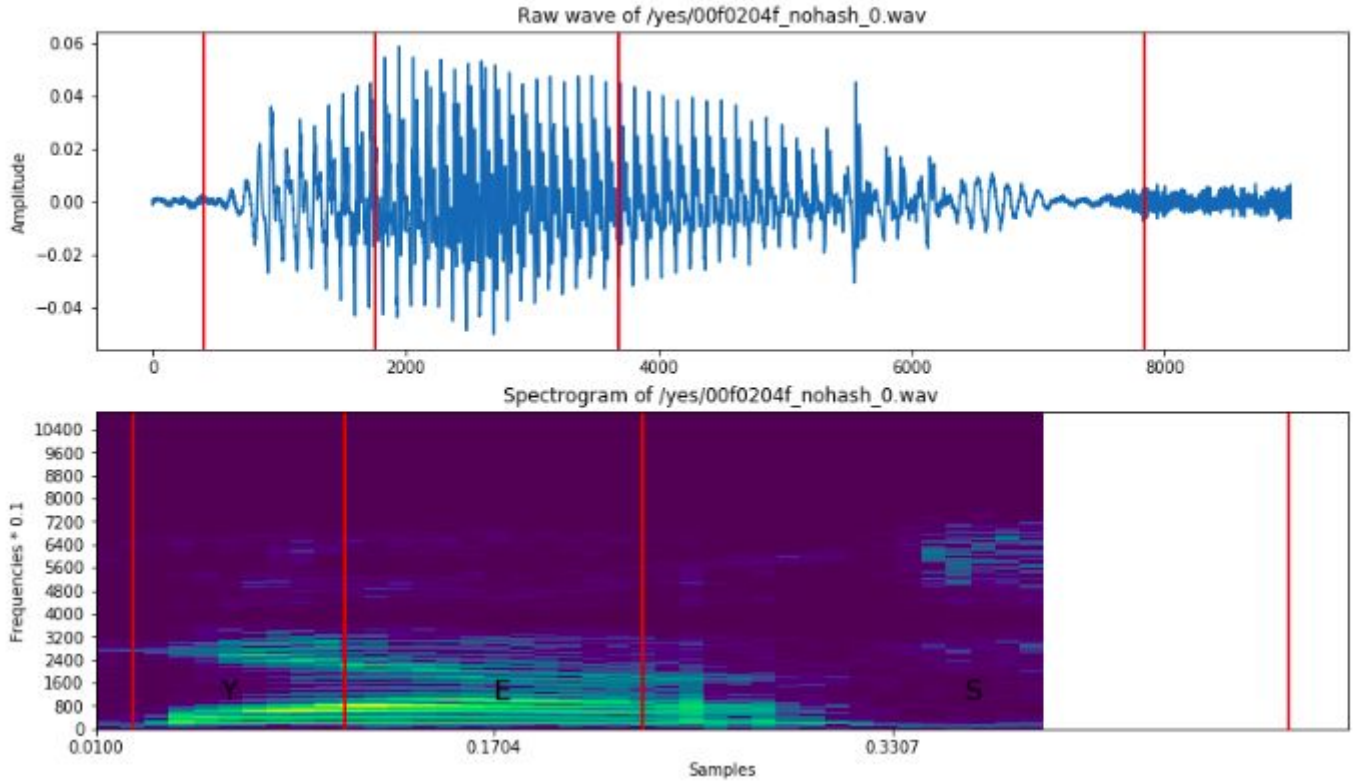

Echo Cancellation

Noise Suppression

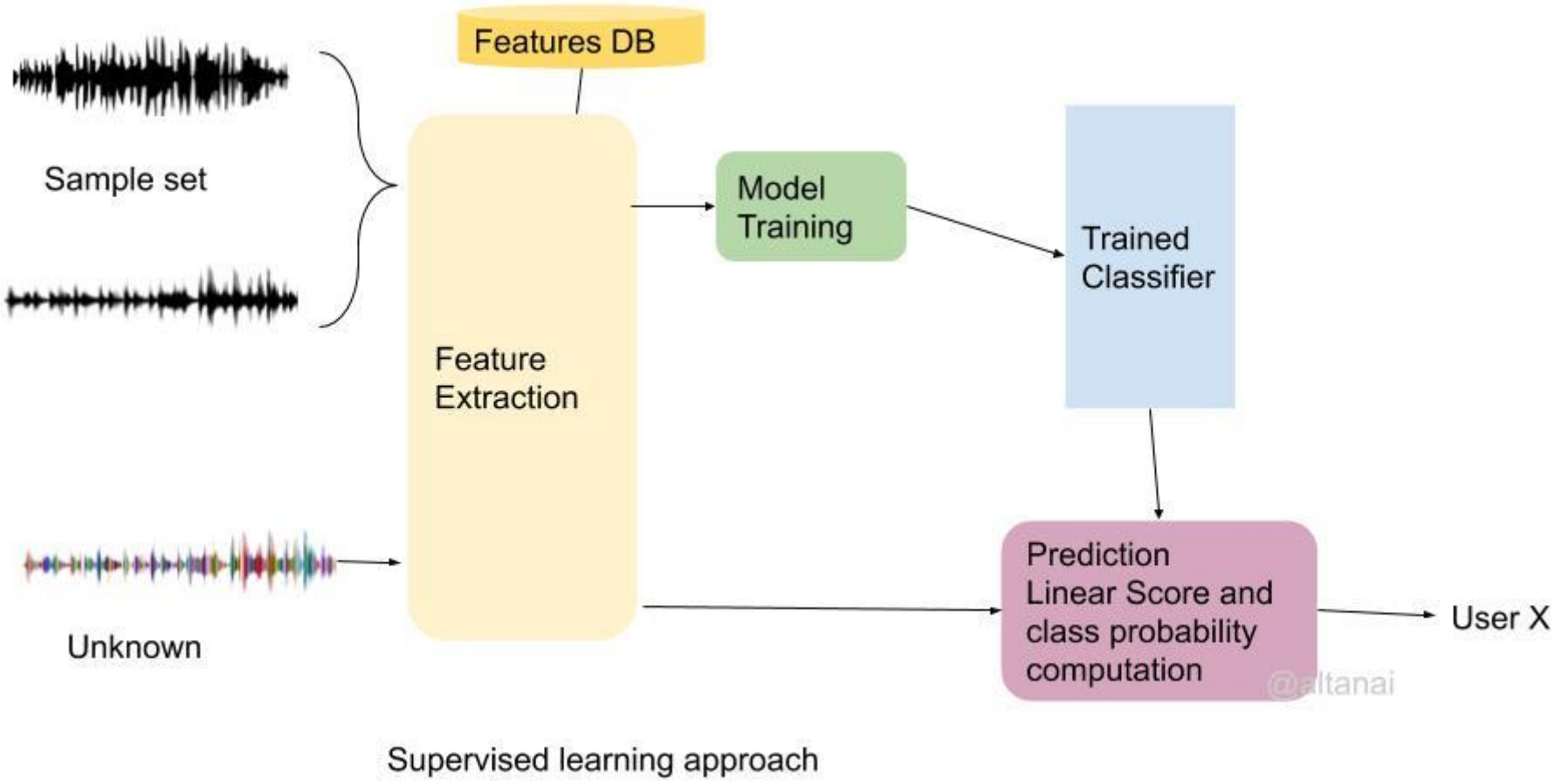
Jitter Control

Image Stabilization

# Voice Activity Detection

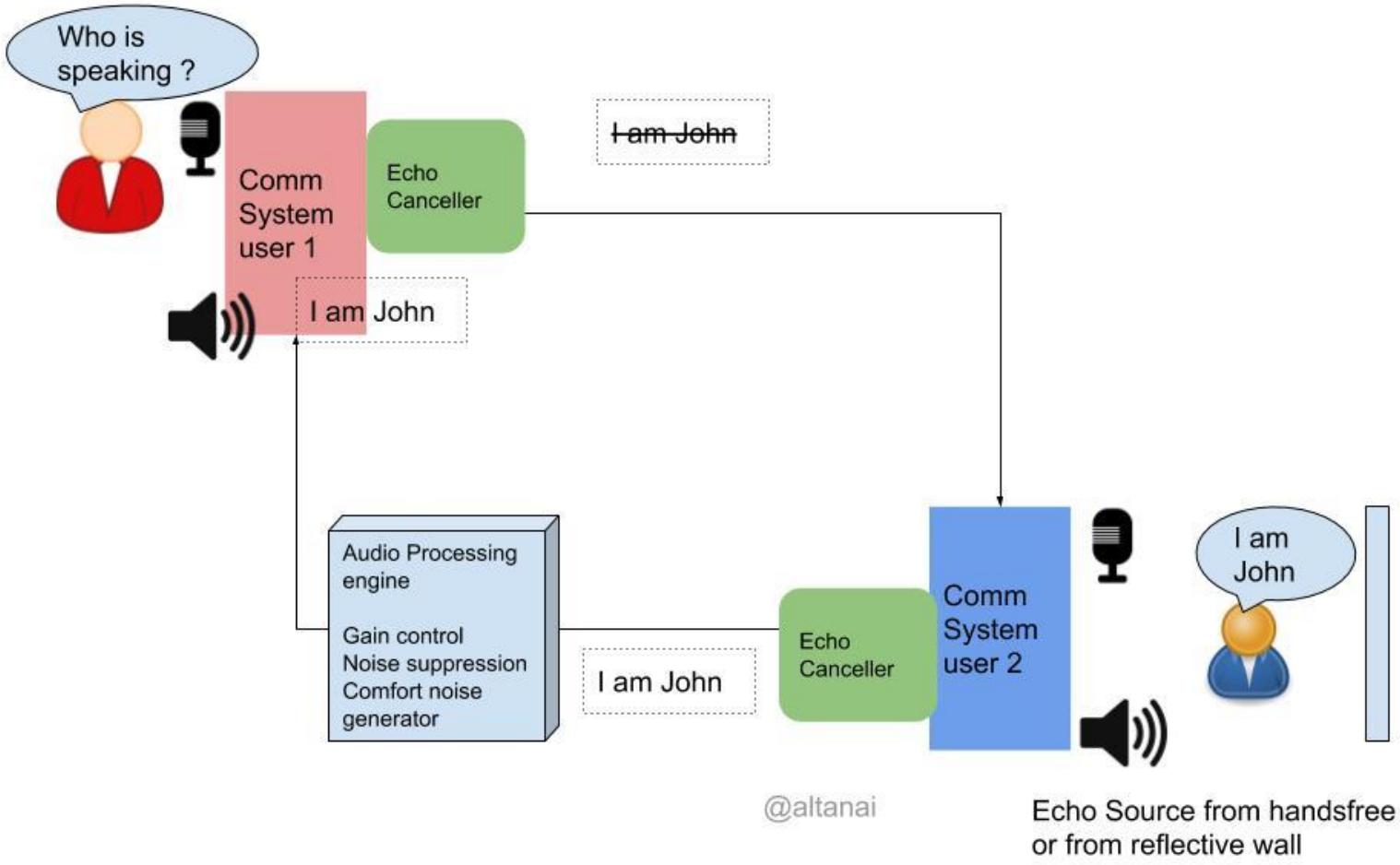


# Audio fingerprinting




Supervised learning approach

# Echo Cancellation



# End device features

Face / Feature Detection

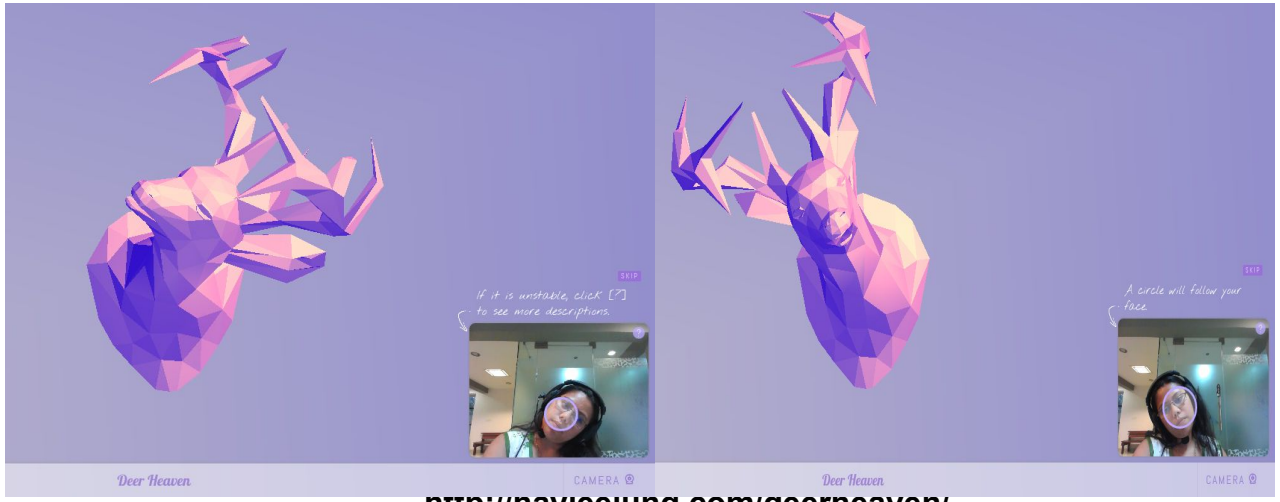
Voice Modulation

Voice Bots / NLP

Background Substitution

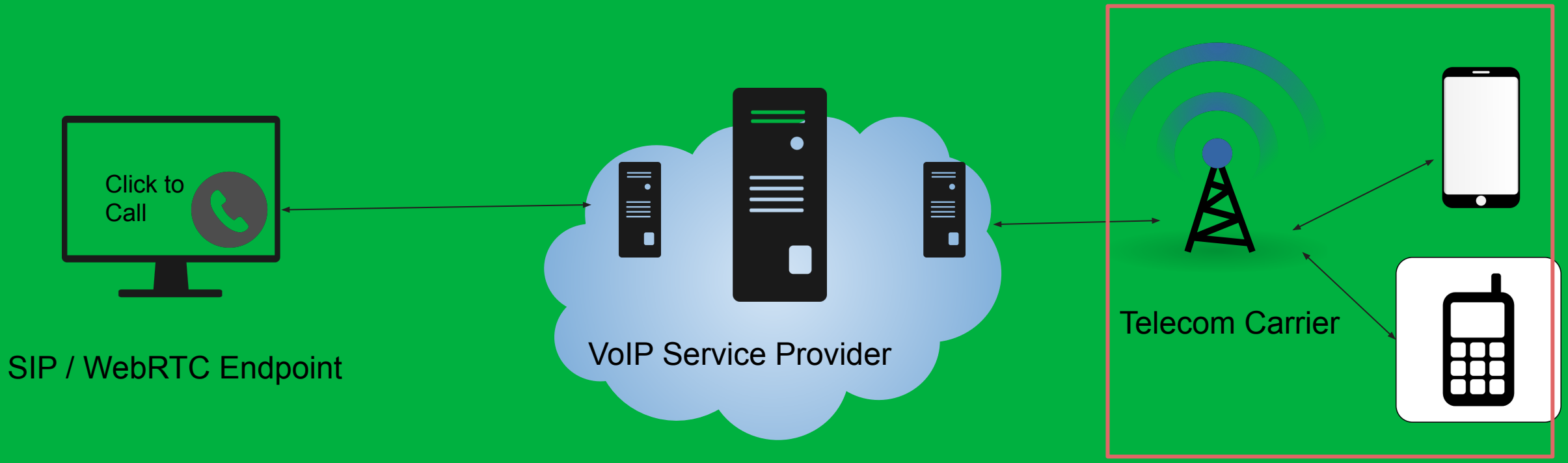
Object Recognition

Object Tracking




http://nayleejung.com/deerneaven/

# Telecom Service based Applications of ANN



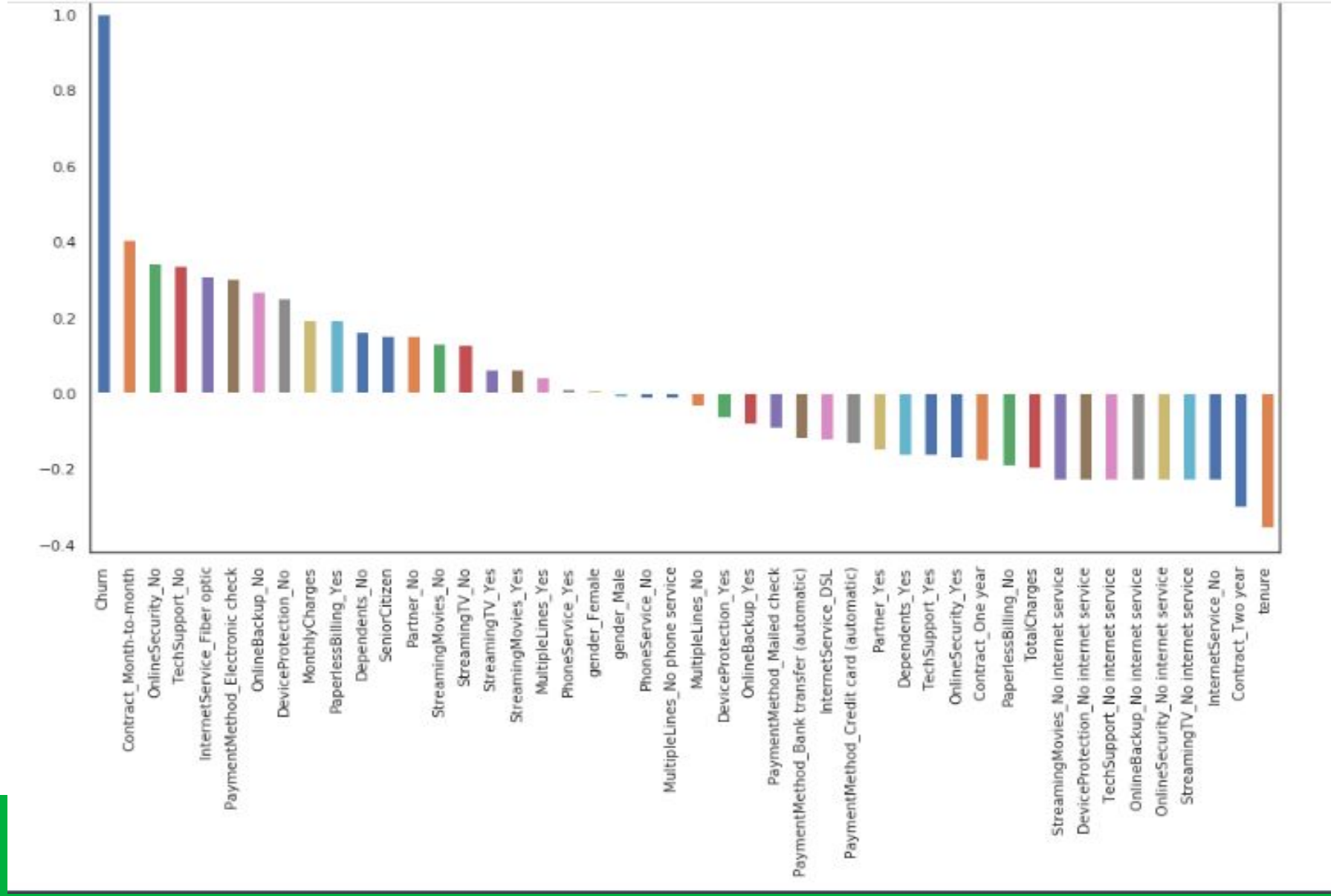
# Subscriber Churn and Outliers

Complains ,

Recharges plans

Collect CDR for daily call patterns

- identify  high call volumes, or extremely long calls, or high call volumes from a particular extension



# Predictive Analysis

Mean Opinion Score (MOS) - key metric for Quality of Service (QoS) of Call

predicting conversational voice quality non intrusively

**Voice quality prediction models and their application in VoIP networks**

Publisher: IEEE | Cite This | PDF

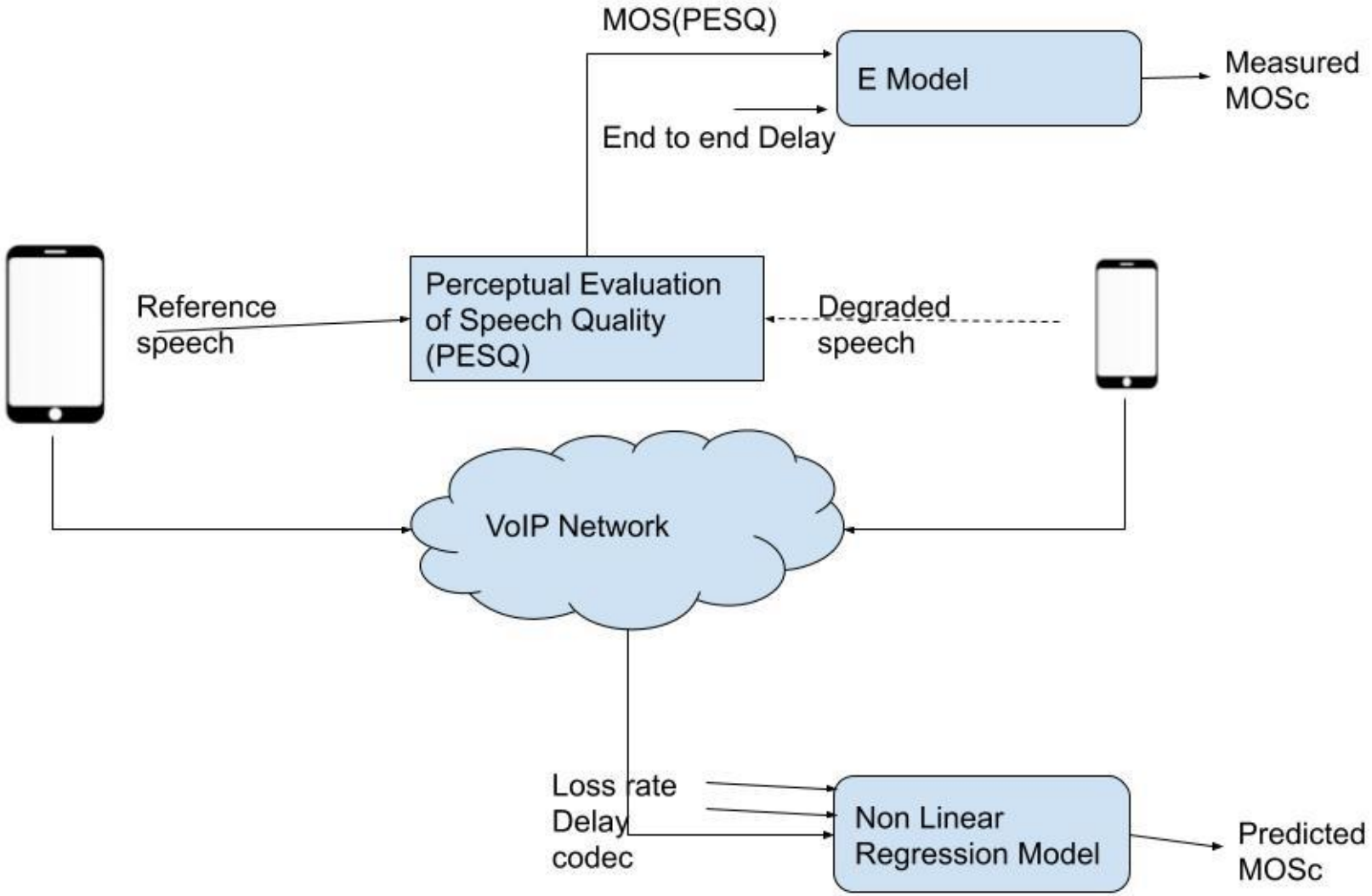
Lingfen Sun ; E.C. Ifeachor **All Authors**

Language Impact on Voice Quality assessment

**VoIP quality measurement: subjective VoIP quality estimation model for G.711 and G.729 based on native Thai users**

**Authors:** Therdpong Daengsi, Nalakkhana Khitmoh, Pongpisit Wuttidittachotti Authors Info & Affiliations

**Publication:** Multimedia Systems • October 2016 • https://doi.org/10.1007/s00530-015-0468-3



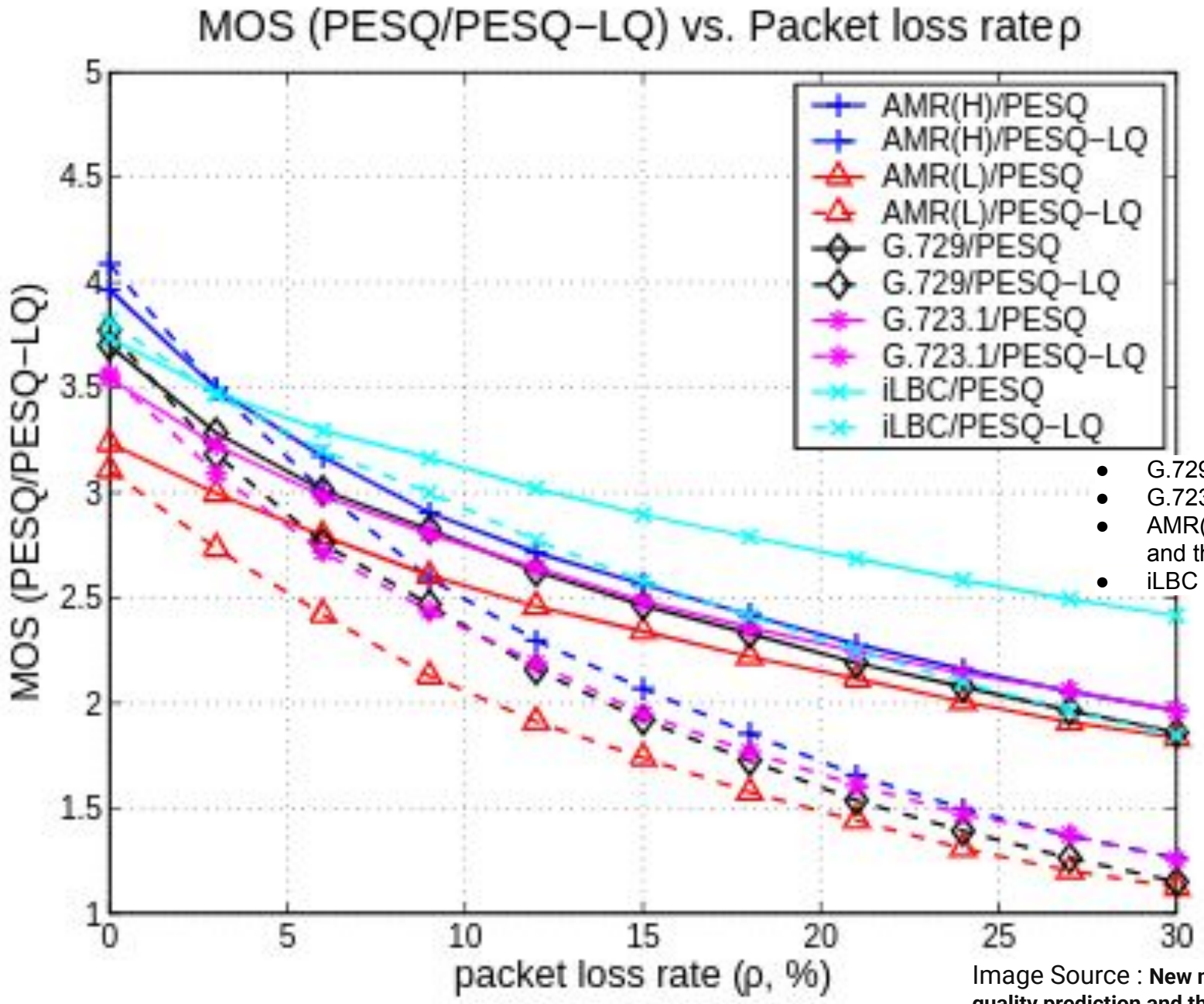

Deduce jitter buffer control and adaptive sender bit rate

Measurement of conversational voice quality using a combined PESQ and E-model.

Ref : Voice Quality Prediction Models and Their Application in VoIP Networks
Lingfen Sun and Emmanuel C. Ifeachor

Performance Metrics of

Packet Loss on Different Codecs



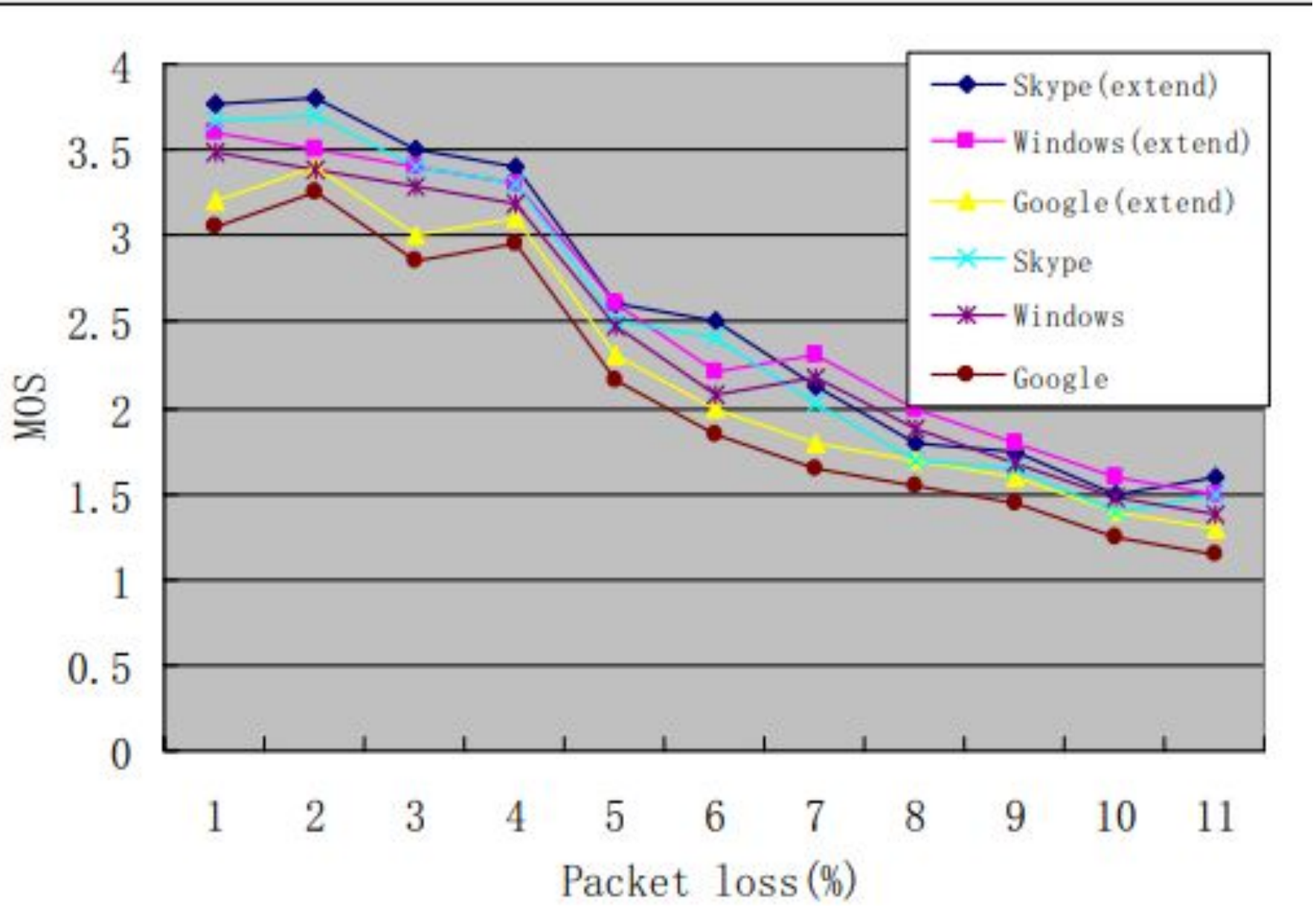

- G.729 (8 Kb/s),
- G.723.1 (6.3 Kb/s),
- AMR(the highest mode, 12.2 Kb/s and the lowest, 4.75 Kb/s)
- iLBC (15.2 Kb/s).

Image Source : **New models for perceived voice quality prediction and their applications in playout buffer optimization for VoIP networks**
Lingfen Sun , Emmanuel Ifeachor

# VoIP provider based Applications of ANN

Performance Metrics of

Packet Loss on Different VoIP Service Providers




Source - QoS Evaluation Based on Extend E-Model in VoIP Hongli Zhangab, Zhimin Gua , Zhenqing Tian- 2011

# Anomaly detection

- Intrusion detection based on Recurrent Neural Network (RNN) model
- Malicious System Call Sequence Detection (MSCSD)

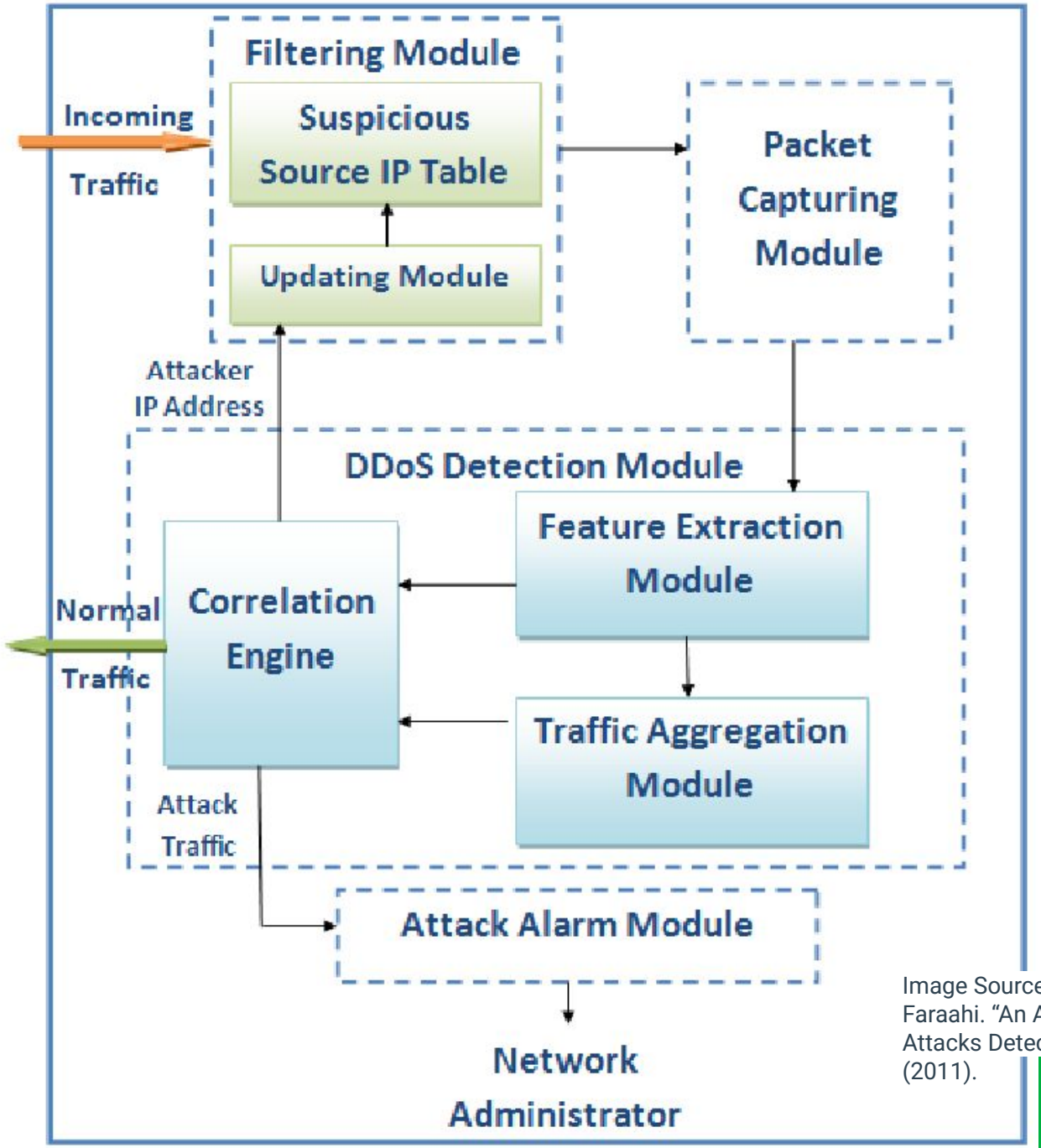



Image Source : Karimazad, Reyhaneh and A. Faraahi. "An Anomaly-Based Method for DDoS Attacks Detection using RBF Neural Networks." (2011).

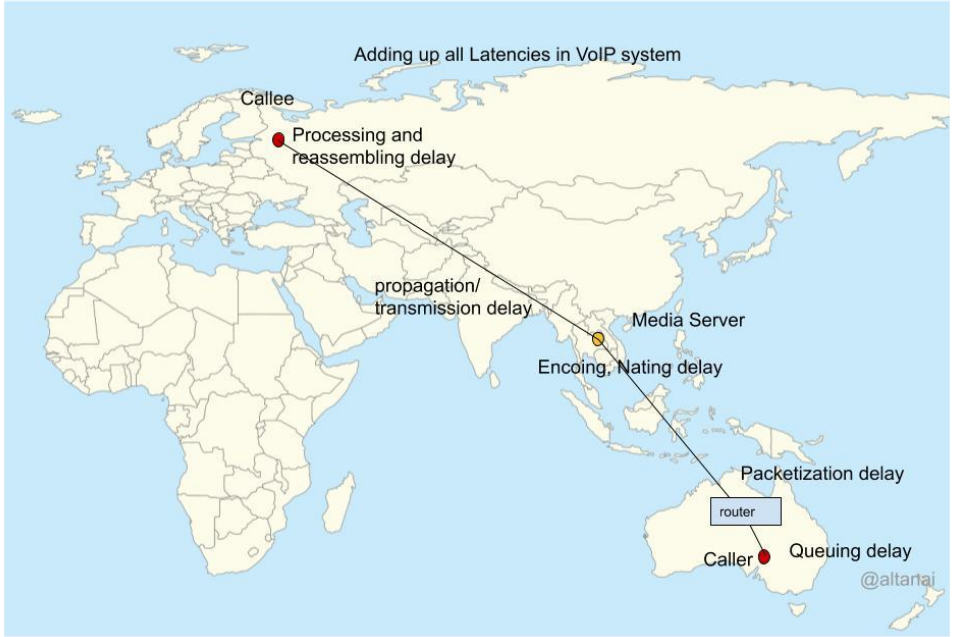
# Additional applications of ANN in voIP

Call Prioritization

Geographical routing

Call pattern mapping

- Bypass additional checks to remove latency




# Unexplored Areas

# Etiquette analysis

Politeness , Courtesy and sticking to matter

- applicable for use cases - Sales , Pre-Sales , Customer Care , Call Centres
- analogous to Sentiment analysis of customers in call

# Regulatory analysis

no pin , passwords to be queried from users on phone

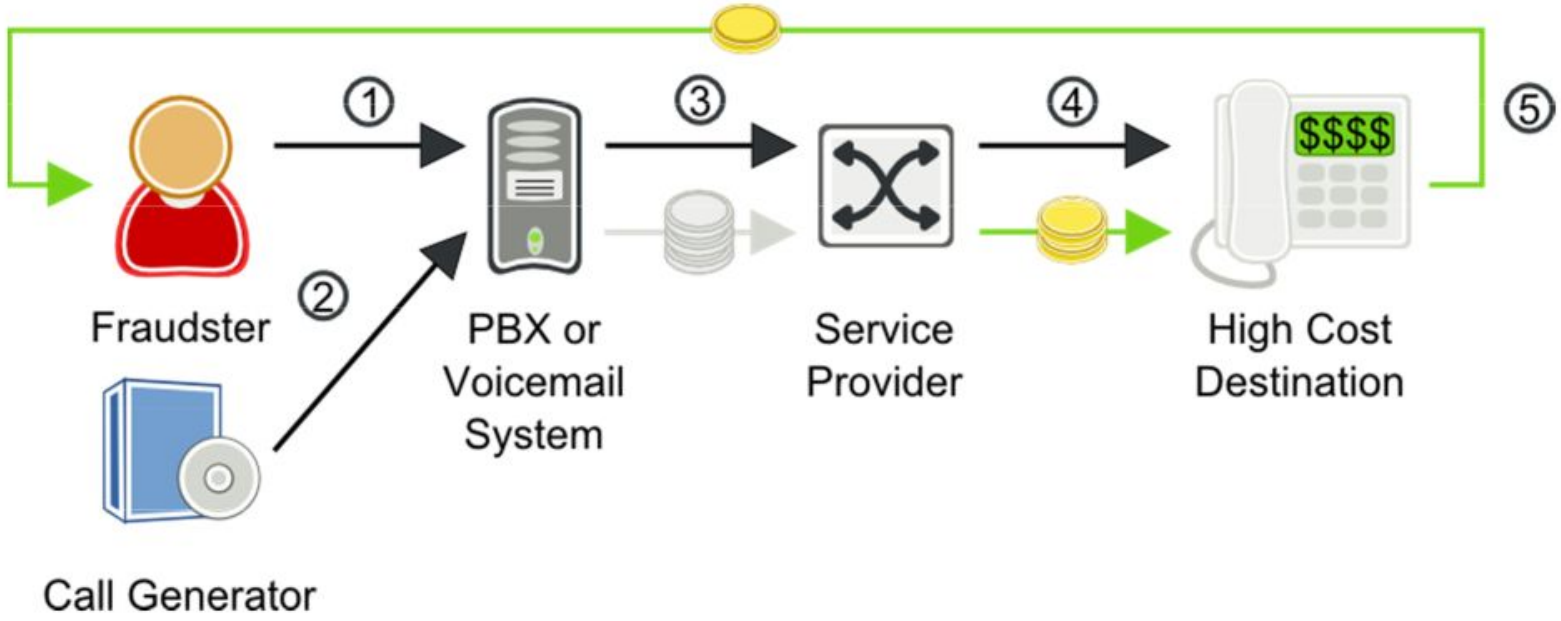
- prevent phishing
- for any pincodes use IVR/ DTMF

# Telecom Fraud

Traffic Pumping
- “access stimulation” techniques to boost traffic to a high cost destination

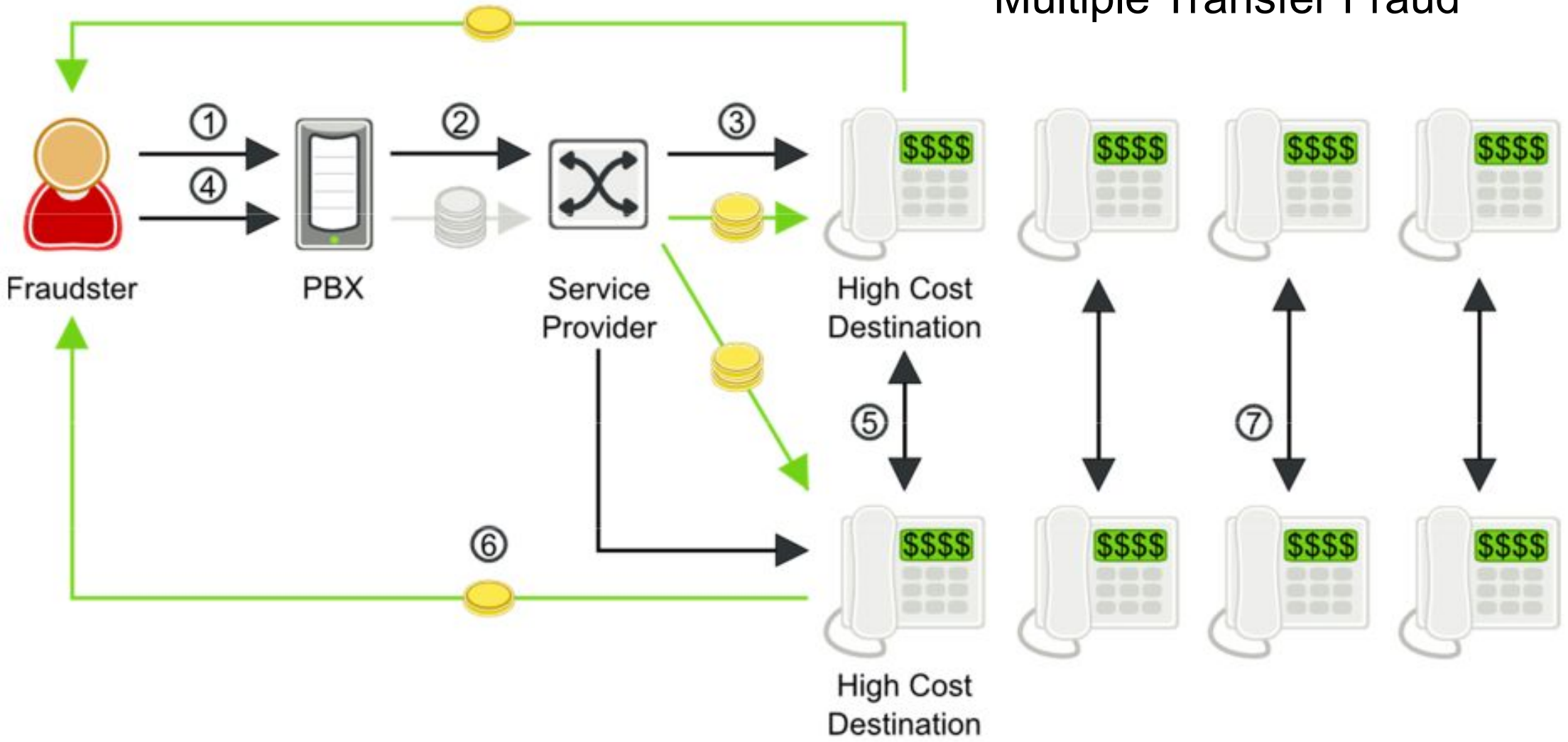
Defraud Telecom Service Providers

- Exploitation of SIP trunks
- regulatory loopholes
- Premium rate numbers misused




Img source : TransNexus

# Multiple Transfer Fraud




Img source : TransNexus

# Other popular VoIP vulnerabilities

One ring and Cut to generate Call back revenue

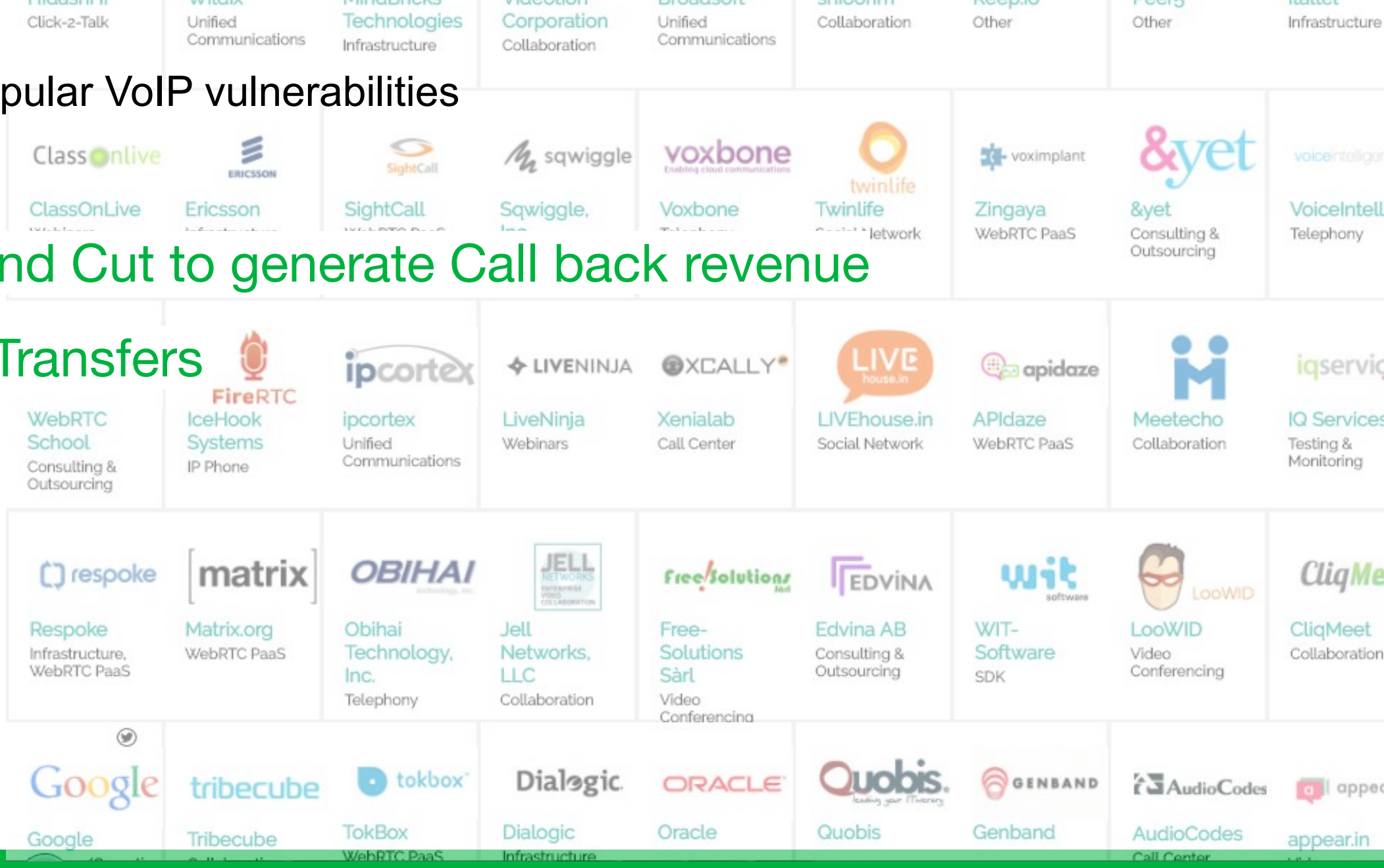
Blind Call Transfers

Call Cards

Vishing

VOMIT

SPIT



# Detection of Fraud and Countermeasures

Call signatures

Risk Assessment

Fraud occur in off-hours

- when networks are often monitored less closely so that they can go unnoticed longer

Back propagation Neural Network to detect SPAM calls

VoIP Intrusion Detection

Aggregate data from  honeypot application and traffic monitoring to ANN

# Recognizing attacks using ANN

## Classifying Possible Intrusions

options tests; options scanning; call testing; unknown protocol; register and call; registration test, registration flooding; register attempt

Aggregate data from honeypot application and traffic monitoring to design response

***References***


- https://telecom.altanai.com/
  - VOIP Call Metric Monitoring and MOS ( Mean Opinion Score)
  - OTT ( Over the Top ) Communication applications
  - CLI/NCLI, Robocalls and STIR/SHAKEN

- Voice Activity Detection - Link Kaggle -https://www.kaggle.comvoice-activity-detection-with-webrtc
- Telecom Churn Prediction - Link kaggle -https://www.kaggle.com/altanai/telecom-churn-prediction
- QoS Evaluation Based on Extend E-Model in VoIP Hongli Zhangab, Zhimin Gua , Zhenqing Tianb a School of Computer Science and Technology, Beijing Institute of Technology b Media College, Inner Mongolia Normal University ,China
- Voice quality prediction models and their application in VoIP networks - September 2006IEEE Transactions on Multimedia DOI: 10.1109/TMM.2006.876279 , Lingfen Sun, Emmanuel Ifeachor
- TransNexus TELECOM FRAUD CALL SCENARIOS
- Nassar, Mohamed & State, Radu & Festor, Olivier. (2007). VoIP Honeypot Architecture. 109 - 118. 10.1109/INM.2007.374775.

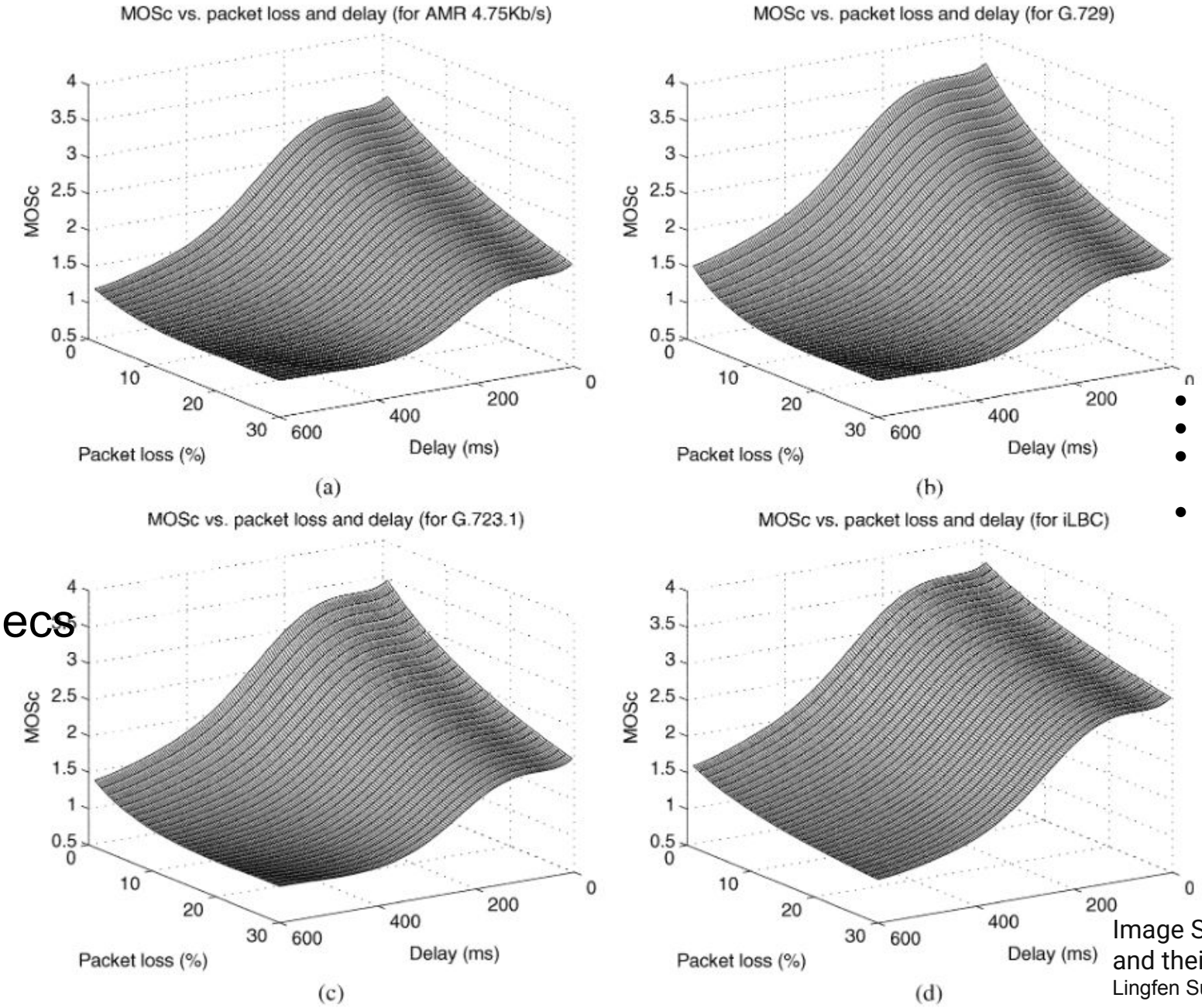
Thank you :)

WOMEN IN DATA SCIENCE

# Extras

# Performance Metrics of

# Packet Loss on Different Codecs

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- iLBC (15.2 Kb/s).

Image Source : Voice quality prediction models and their application in VoIP networks
Lingfen Sun , Emmanuel Ifeachor

Fig. 12. *MOSc* versus packet loss and delay for different codecs: (a) for AMR (4.75 Kb/s); (b) for G.729; (c) for G.723.1; (d) for iLBC.