Research on the road to the Last Mile

Using behavioral insights to solve real problems for real people

Peace keeping efforts

Crisis negotiations

Business negotiations & sales

Interviewing

Clinical assessment & medical compliance

Border Security

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Agenda

- Motivation
- Proof of concept – Research Model
- Proof of value – Problems Research Addresses
- Proof of use – Applications Research Makes Possible
- Current Results

Motivation

Advancing Technology, More Data, Fresh Theories, & New Discoveries

Emotion Detection and Recognition (EDR):

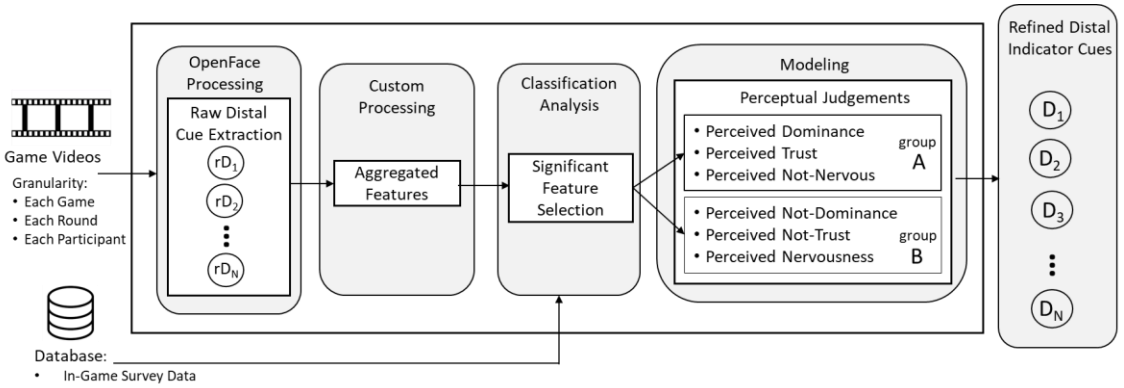
- Understanding emotion holds significance during the interaction process of communication between humans, and human & machine systems.
- The global EDR market was valued at USD 12.37 billion in 2018 and is expected to reach a value of USD 91.67 billion by 2024.
- The key areas where emotion detection and recognition are expected to gain traction include entertainment, transportation, healthcare, and retail.

-- Market Reports World, report (01-May-2019):
"EMOTION DETECTION AND RECOGNITION (EDR) MARKET - GROWTH, TRENDS, AND FORECAST (2019 - 2024)"

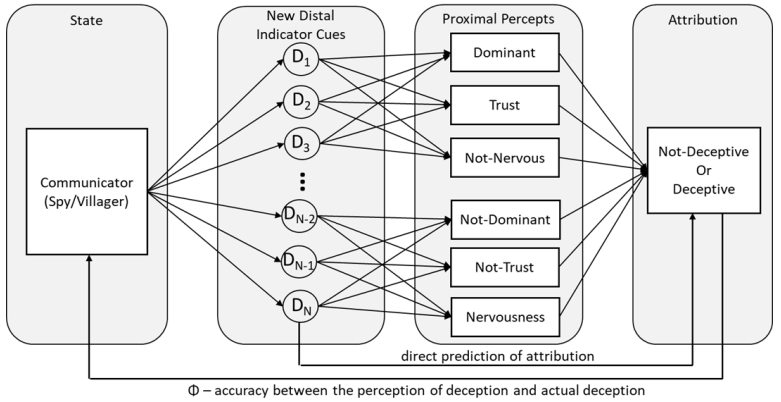
Proof-of-Concept (Research Model)

- Does It Work

1st Analysis: Uncovering Important Features

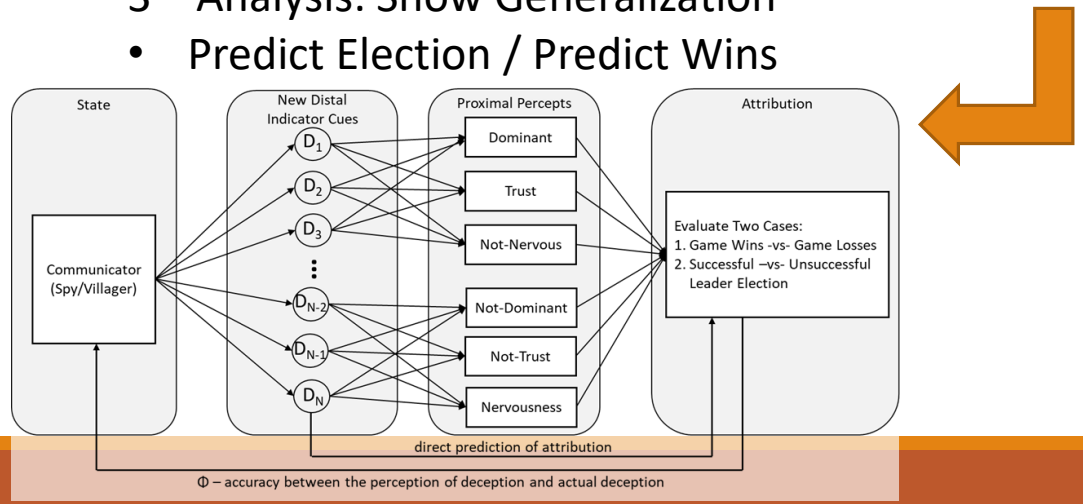


2nd Analysis: Predicting Deception



3nd Analysis: Show Generalization

- Predict Election / Predict Wins



Proof-of-Value
(Problems Research Addresses)

- Why is it useful

- Emotion Understanding
  - Much research shows the better we understand emotions the better we can act strategically to achieve desired outcomes
  - In a survey of 15+ commercially available emotion detection APIs, none report – Dominance, Trust, Nervousness.

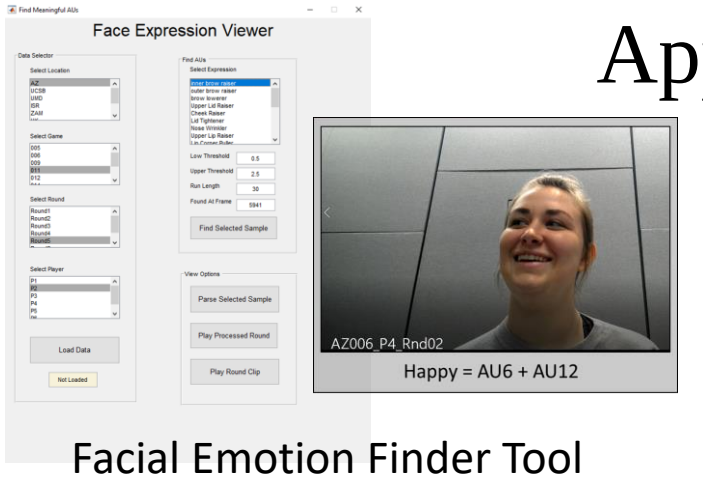
Paralleldots	Kairos	Face++
Emotient	Project Oxford	Imotions
Affectiva	Face Reader	CrowdEmotion
EmoVu	Sightcorp	FacioMetrics
Nviso	SkyBiometry	OpenFace

- Deception Detection
  - "Deception is a disease for which there is no cure and an unending opportunity to combat it".
    -- Dr. Bruce Reinig

Proof-of-Use

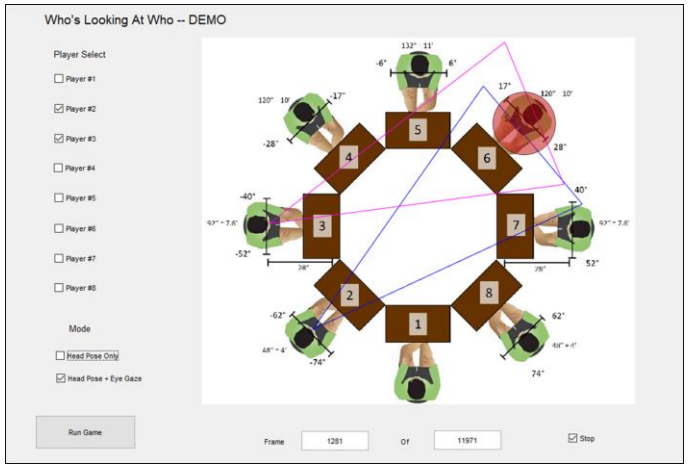
Applications Research Makes Possible

- Is it useful?



Happy = AU6 + AU12

Facial Emotion Finder Tool



Who's Looking At Who w/h Speaker Indicator

Tools & Applications

Interview Coaching

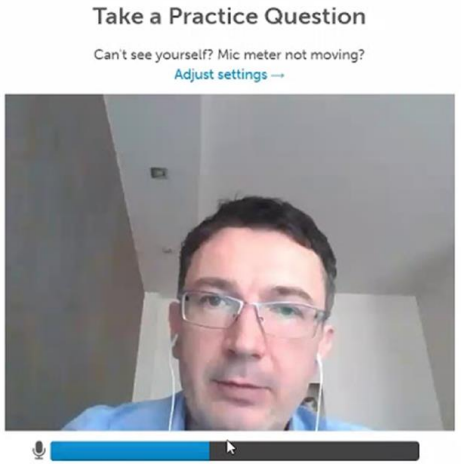
- Provide feedback for video interviews to improve interview performance

Physical Therapy

- Create tool for facial mobility feedback to assist stroke victims for re-training of facial muscle control

Integration into Augmented Reality (AR) Systems

- would provide real-time tactical advantages during one-on-one crisis situations.
- Initial focus may target applications for:
  - Military Operations
  - First Responders
  - Crisis Negotiators



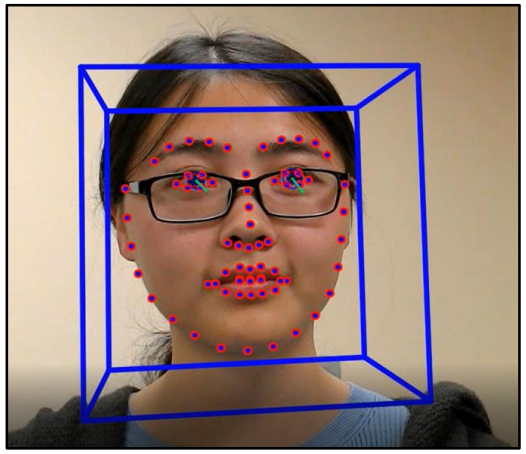
Interview Coaching w/h Auto-Feedback

Commercial To Military

AR with HUD for Emotion Detection

Current Results

Raw Kinesics



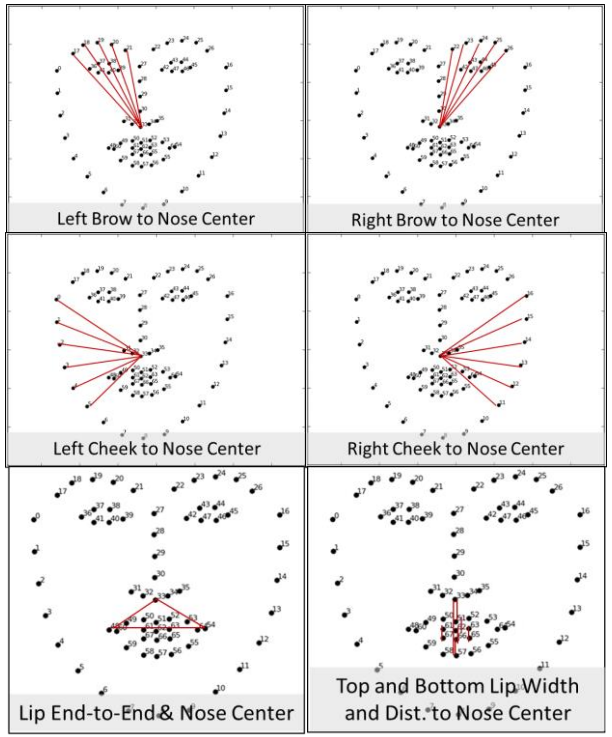
Eye Gaze Vector
Head Pose
Face Landmarks 2D & 3D

AU #	FACS name
1	Inner brow raiser
2	Outer brow raiser
4	Brow lowerer
5	Upper lid raiser
6	Cheek raiser
7	Lid tightener
9	Nose wrinkler
10	Upper lip raiser
12	Lip corner puller
14	Dimpler
15	Lip corner depressor
17	Chin raiser
20	Lip stretcher
23	Lip tightener
25	Lips part
26	Jaw drop
28	Lip suck
45	Blink

18 Facial
Action Units (AUs)

Emotion	Action Units
Happiness	6 + 12
Sadness	1 + 4 + 15
Surprise	1 + 2 + 5 + 26
Fear	1 + 2 + 4 + 5 + 7 + 20 + 26
Anger	4 + 5 + 7 + 23
Disgust	9 + 15 + 16

6 Basic Emotions



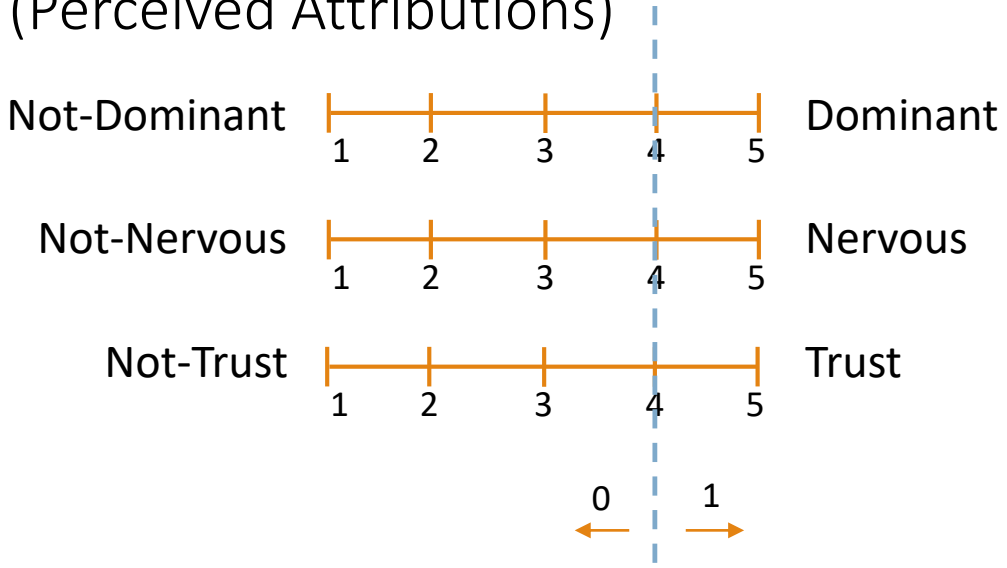
10 Facial Rigidity Values

Values Direct From Openface

Calculated Values From Openface Data

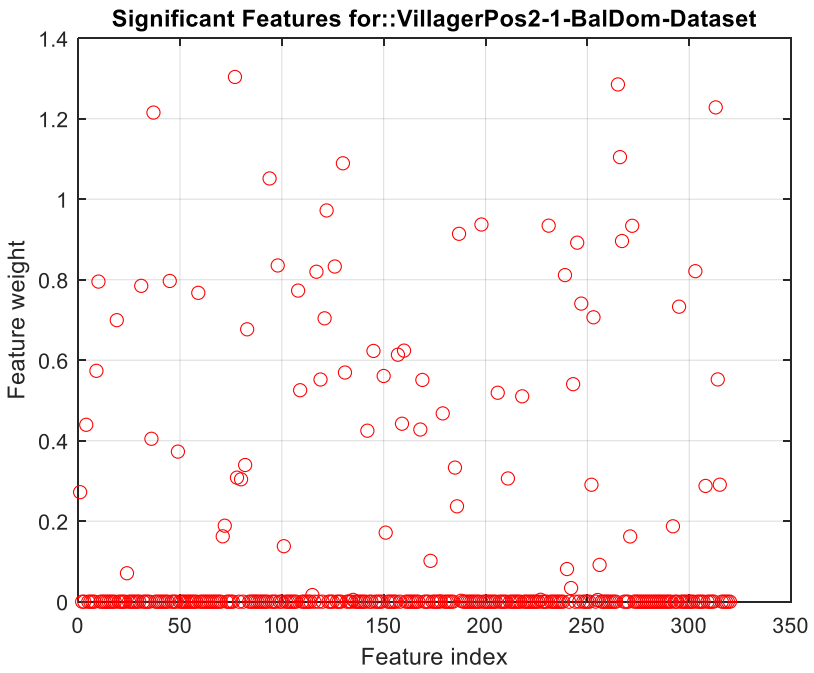
Truth Data

In-Game Survey (Perceived Attributions)

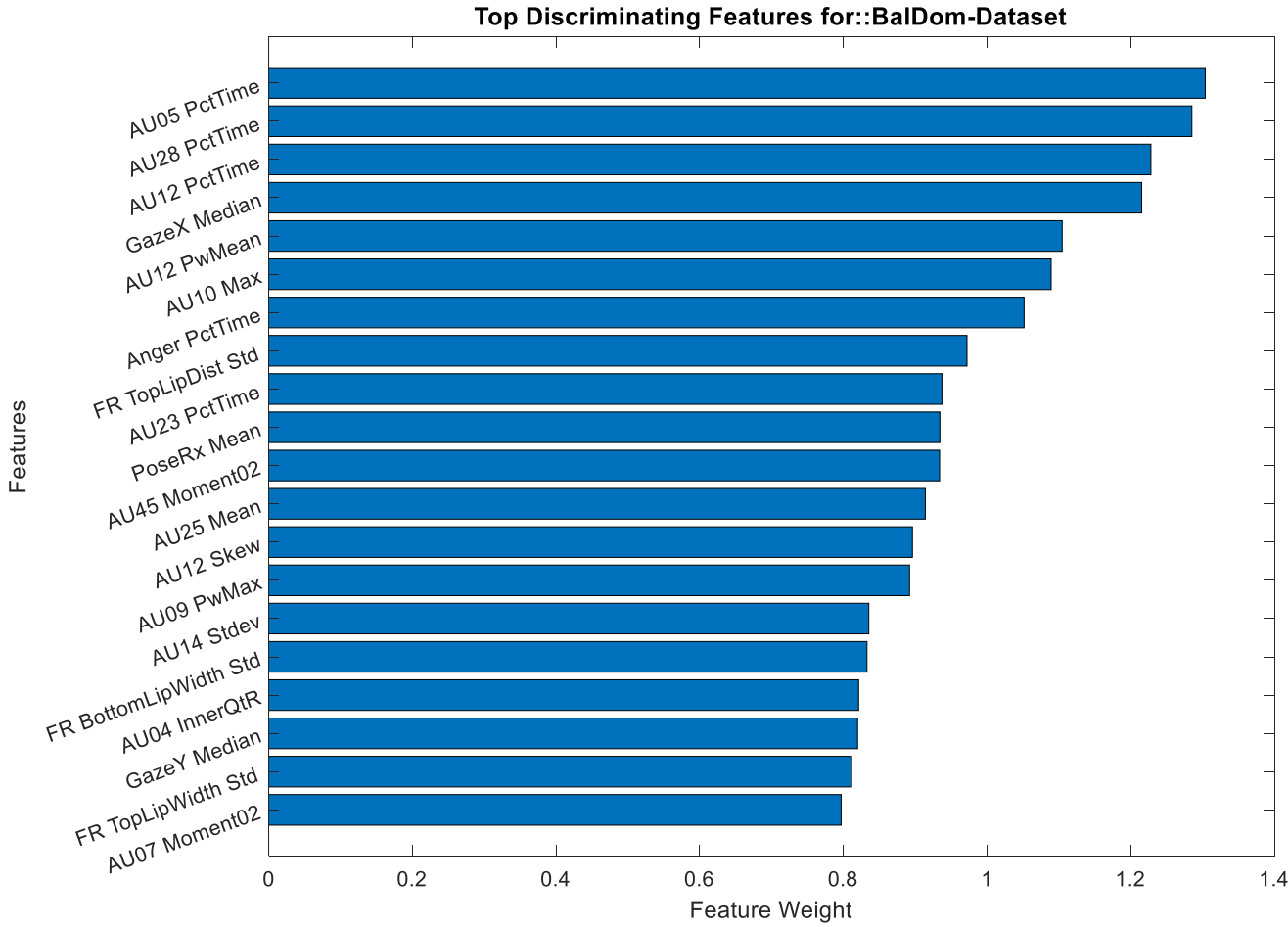


Game Role

Perceived Dominance Feature Analysis

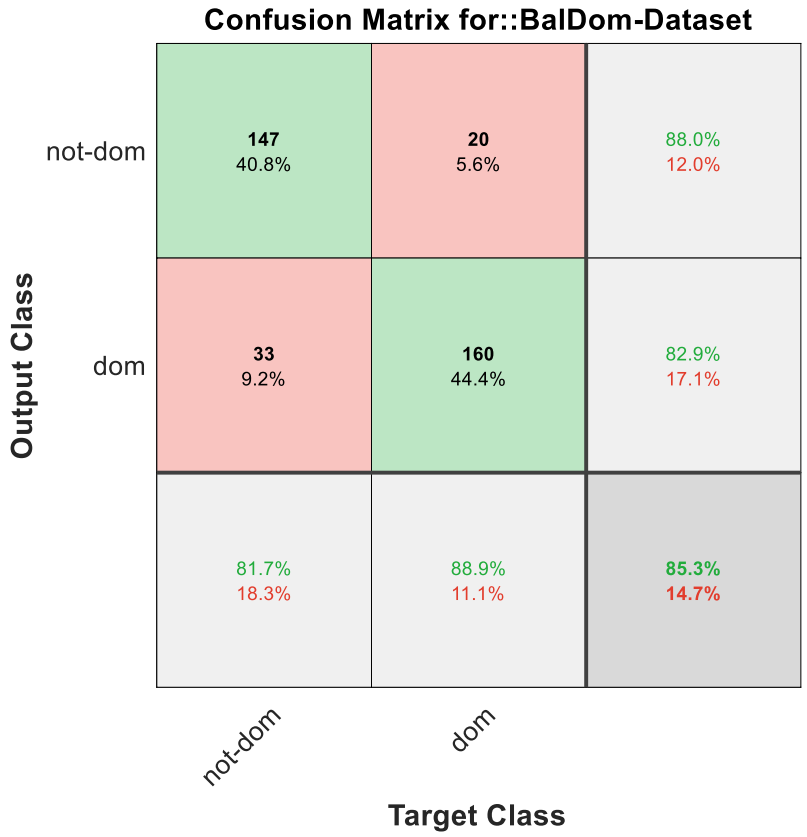


Top 20
Sorted in Order
of Significance

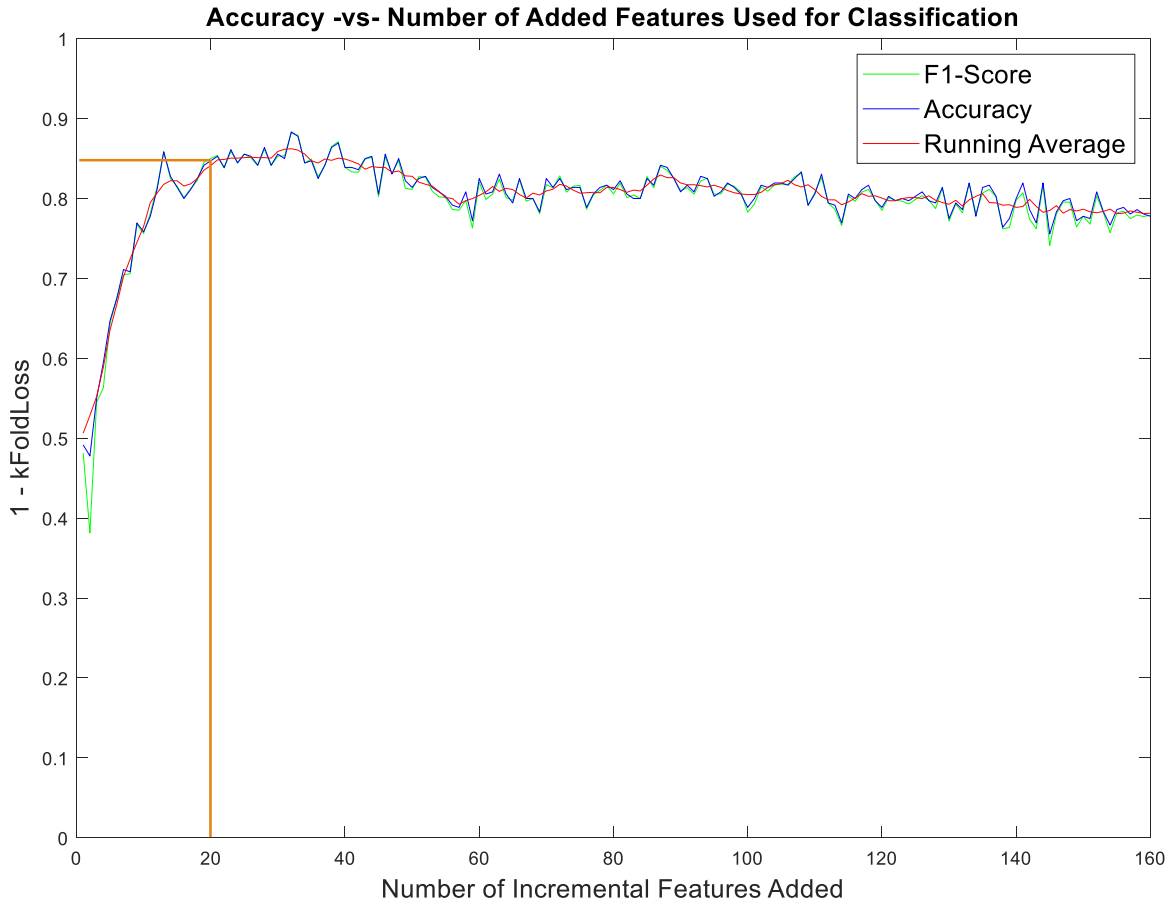


Perceived Dominance Classification

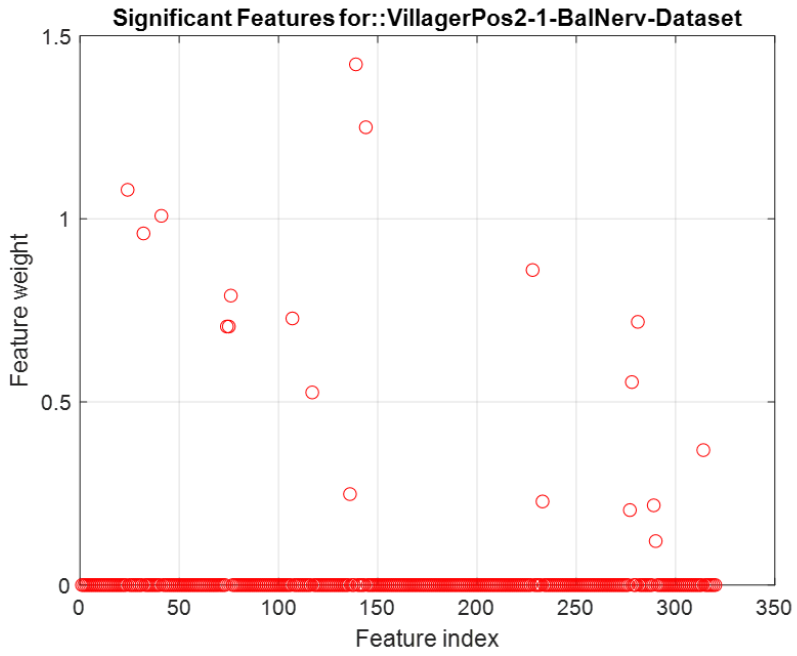
Using 20 Features



Examining accuracy by adding one feature at a time



Perceived Nervousness Feature Analysis



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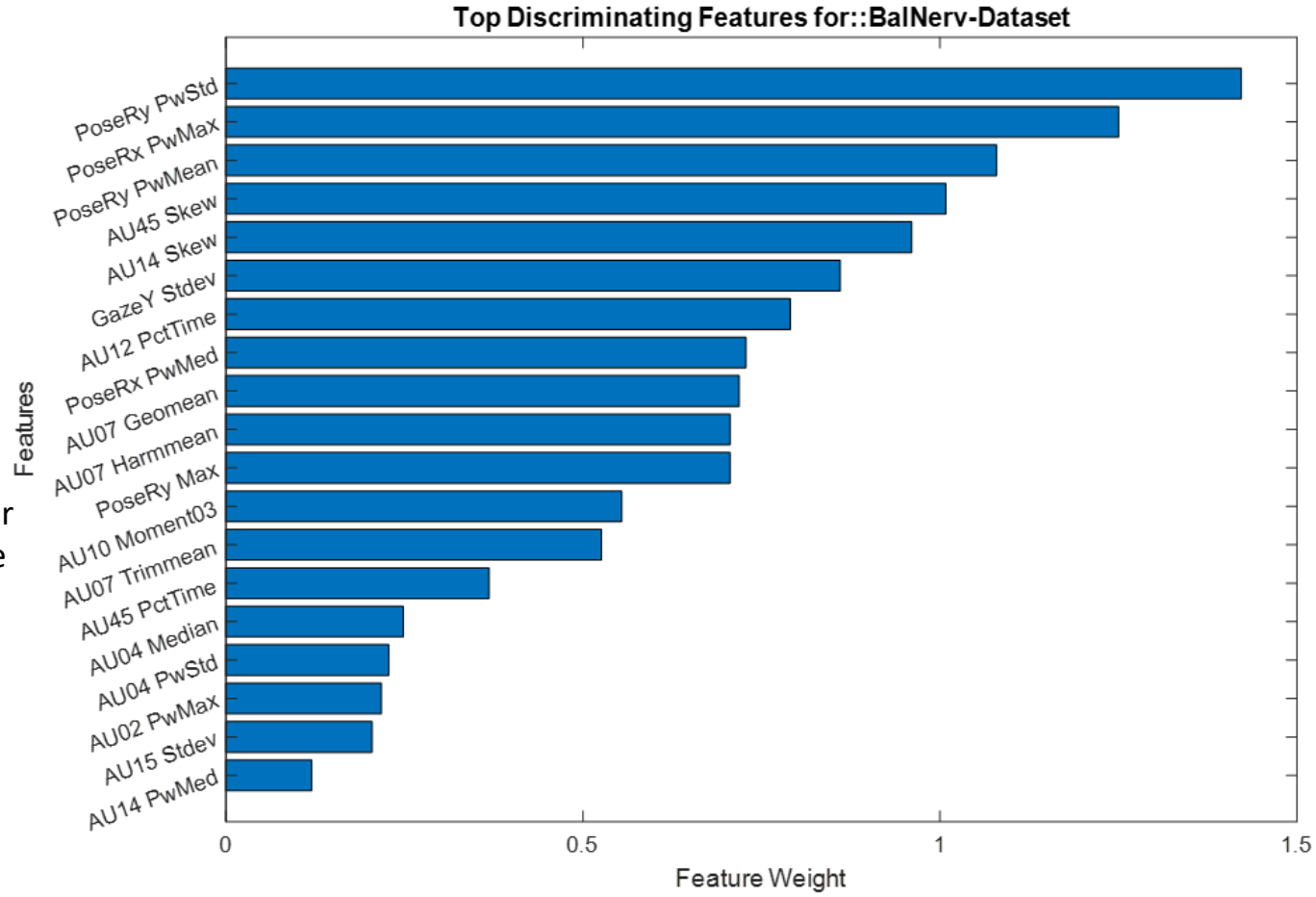
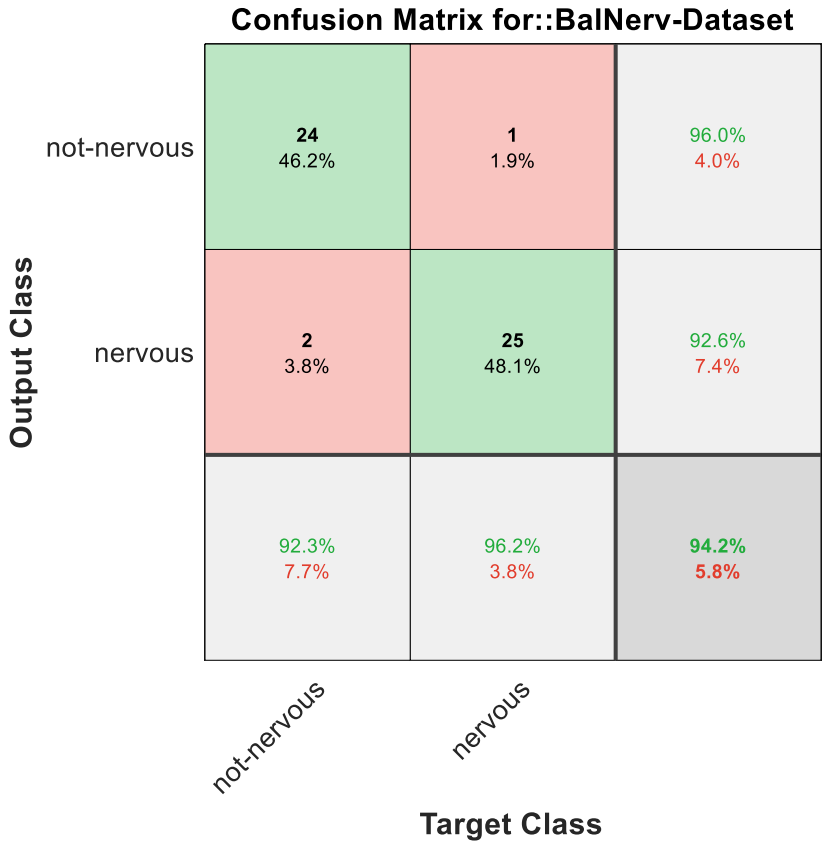


Perceived Nervousness Classification

Using 20 Features



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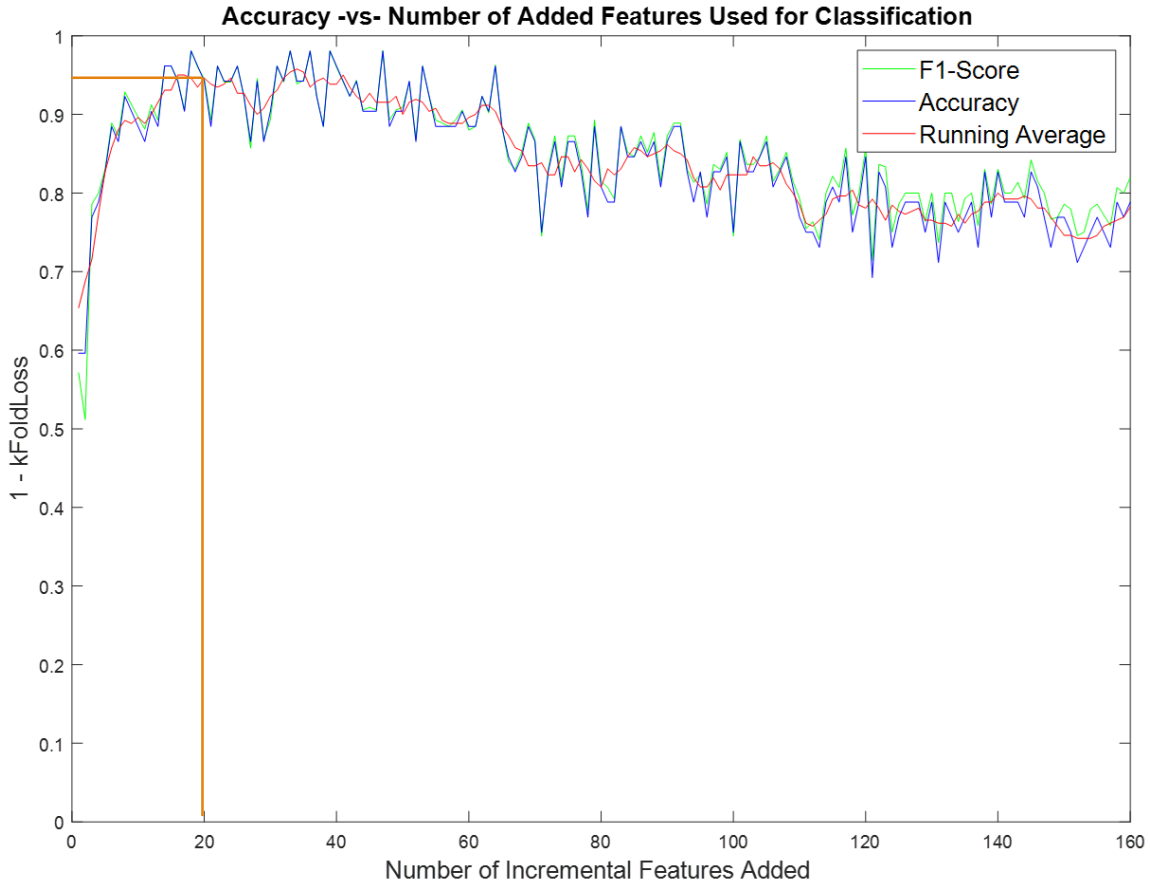
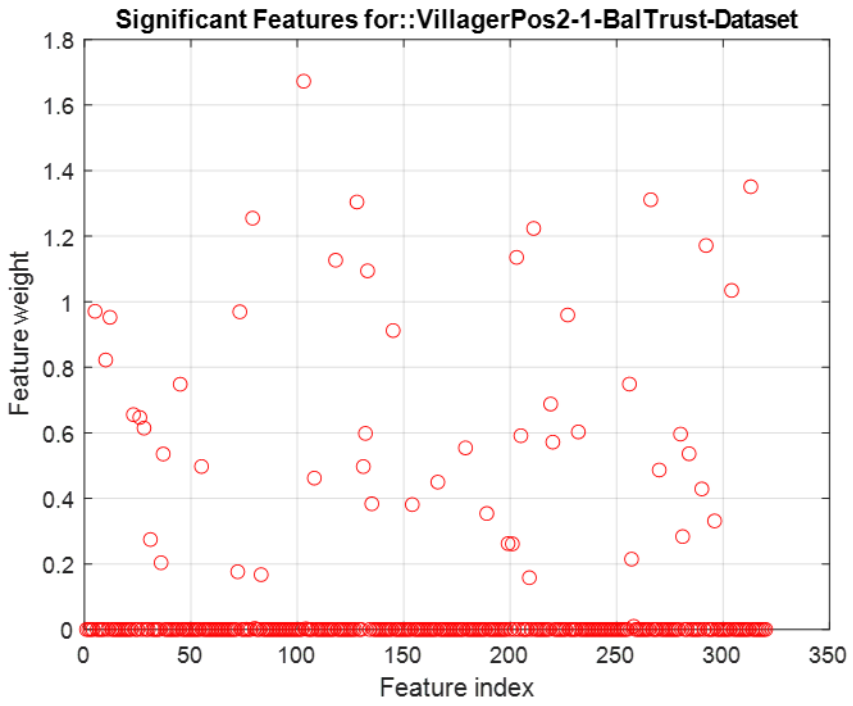


Perceived Trust Feature Analysis



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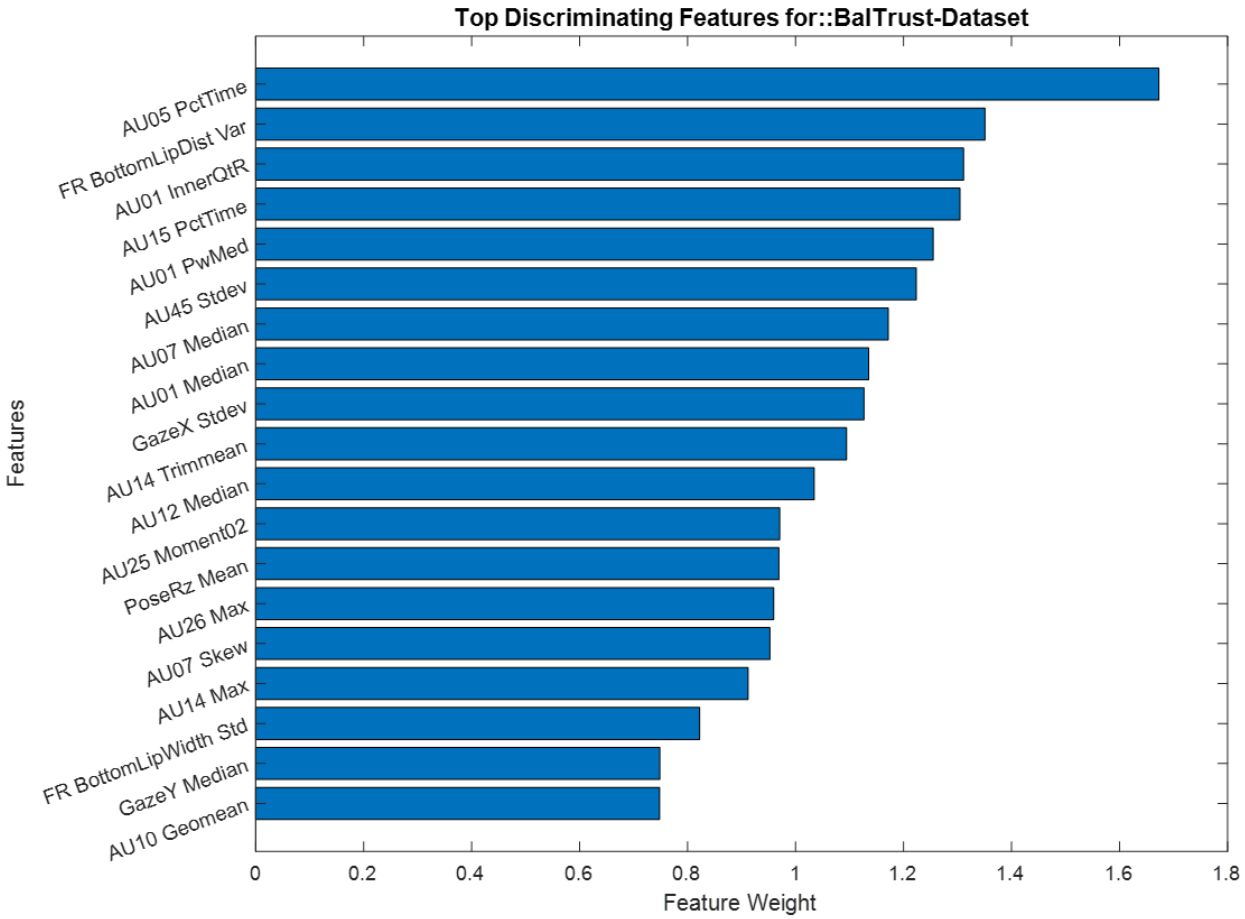
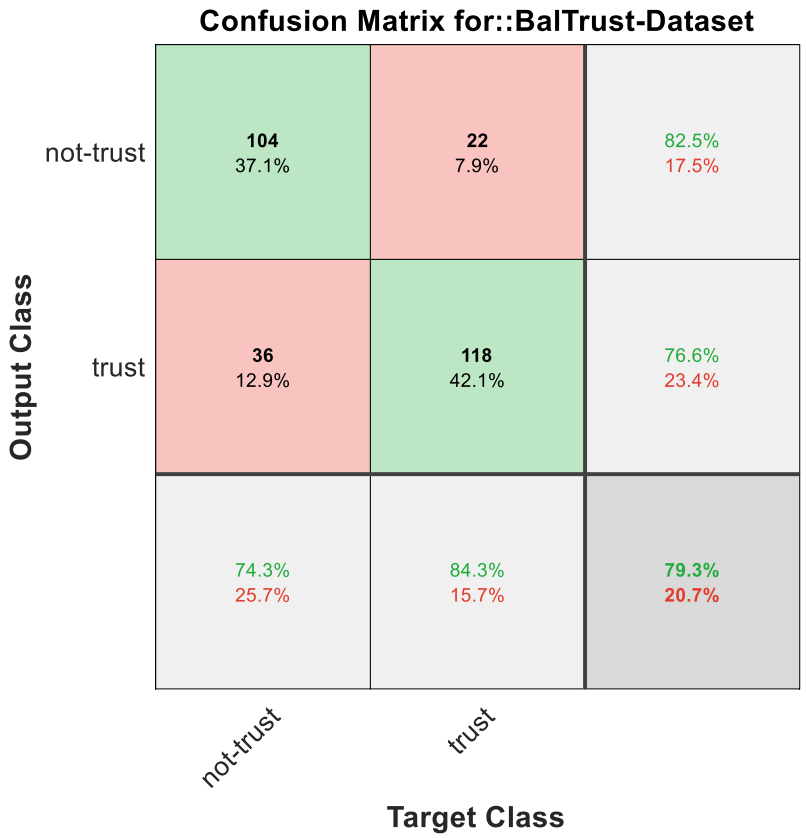


Perceived Trust Classification

Using 20 Features



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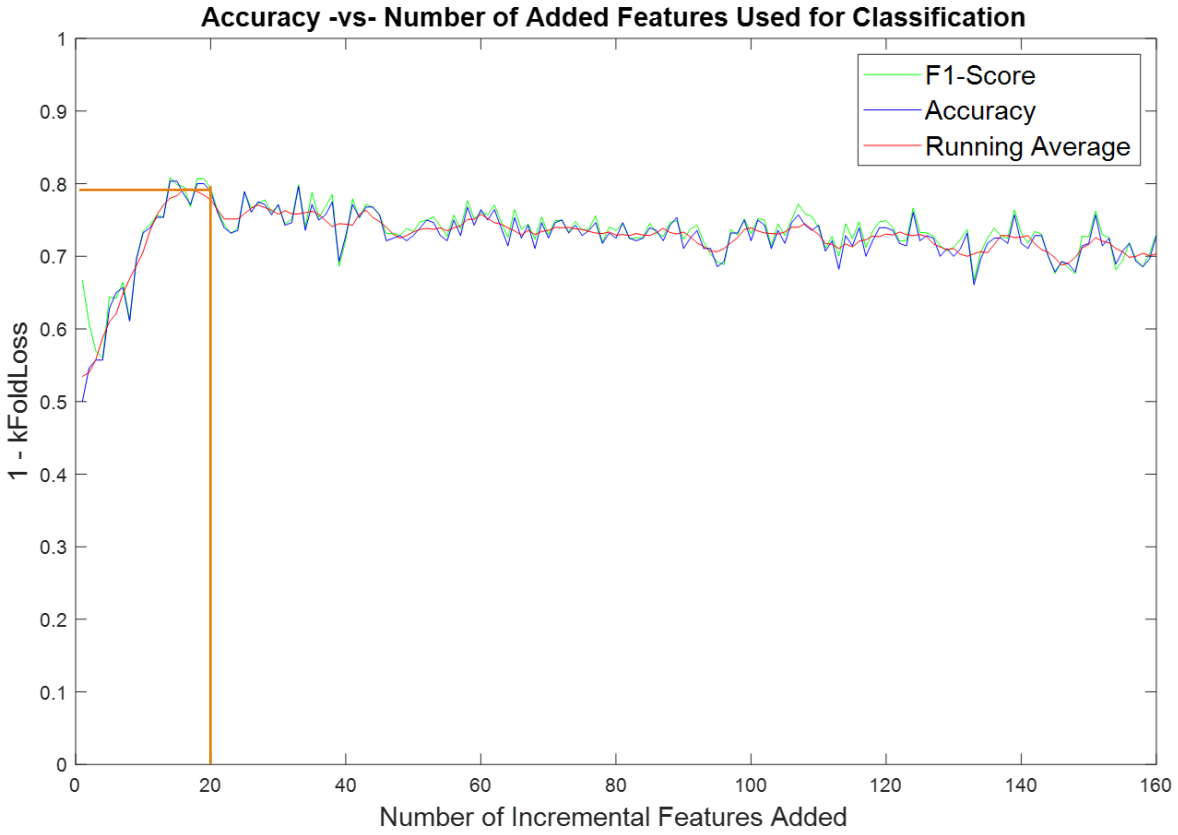
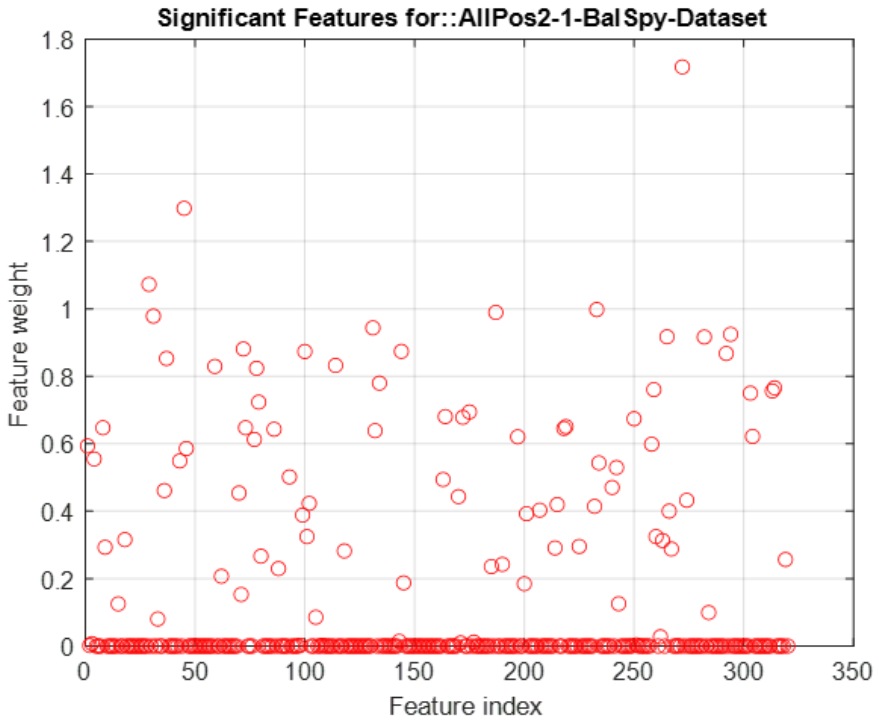


Deceiver Feature Analysis



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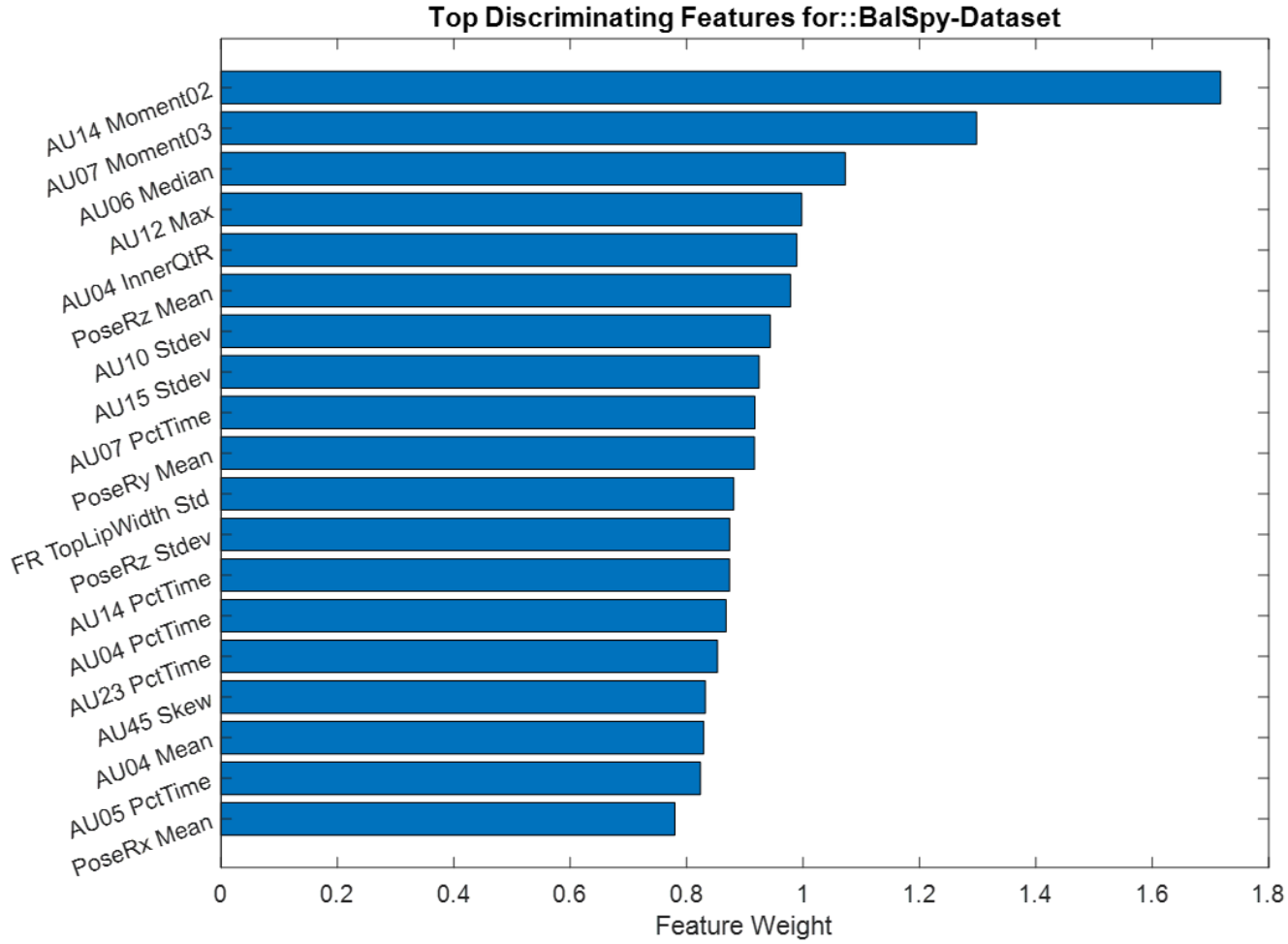
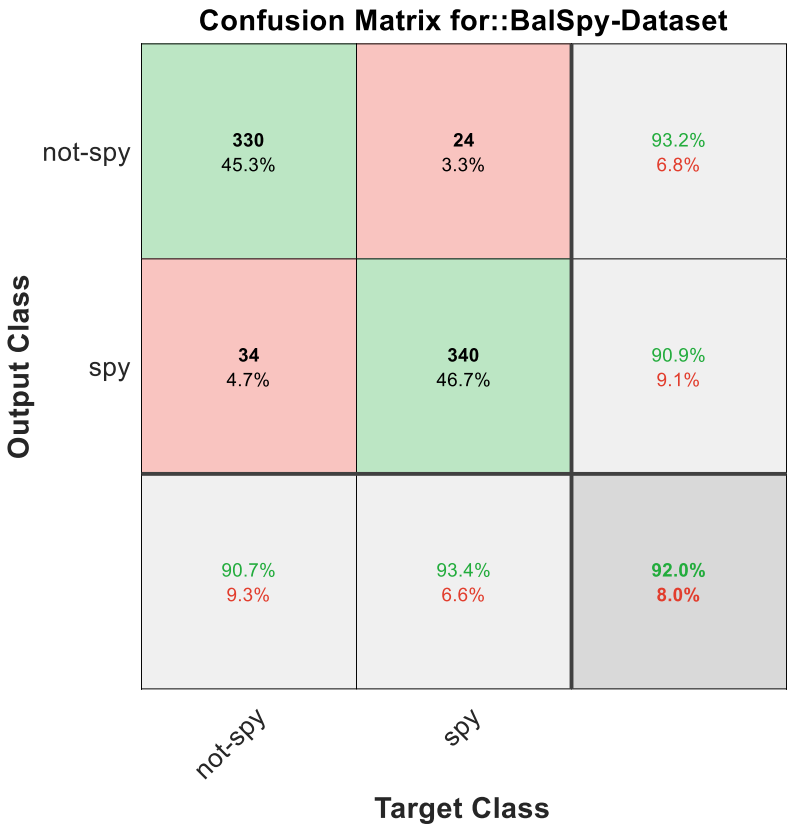


Deceiver Classification

Using 20 Features



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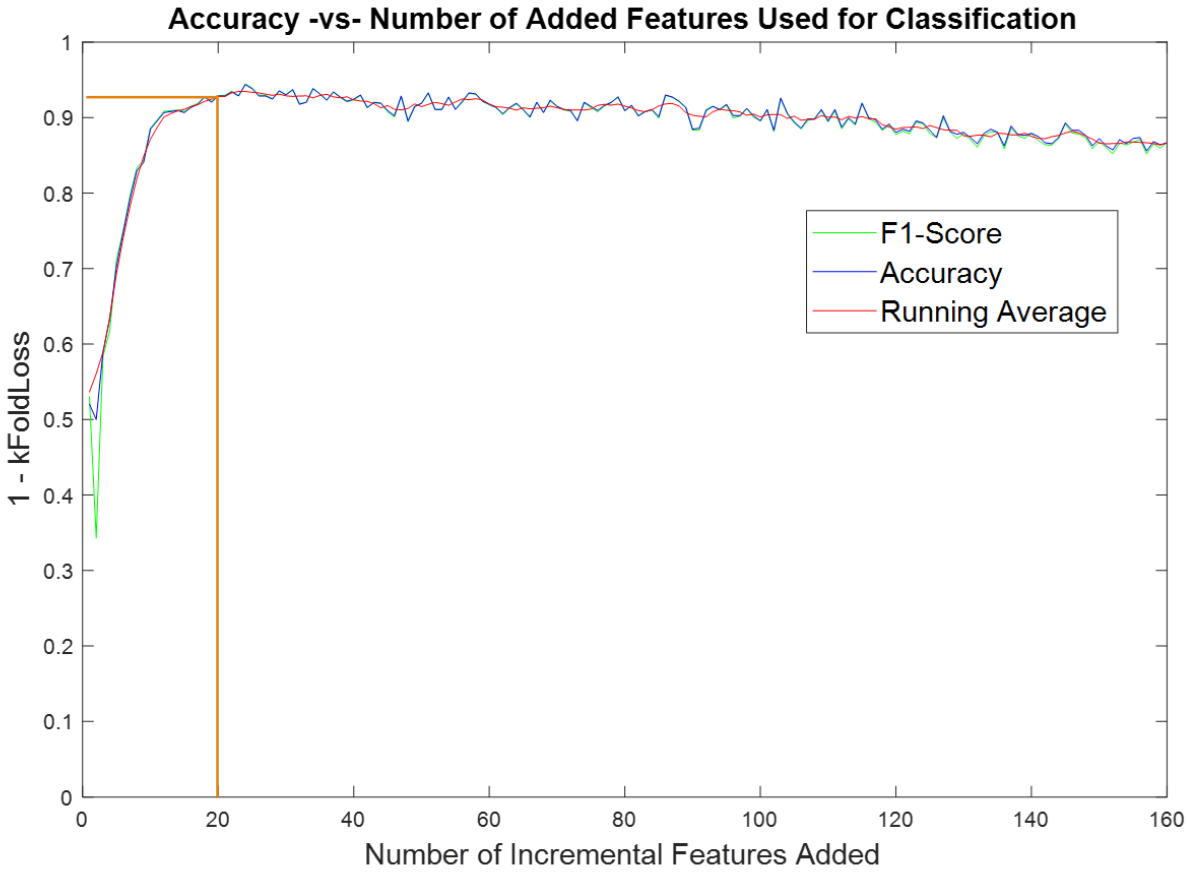
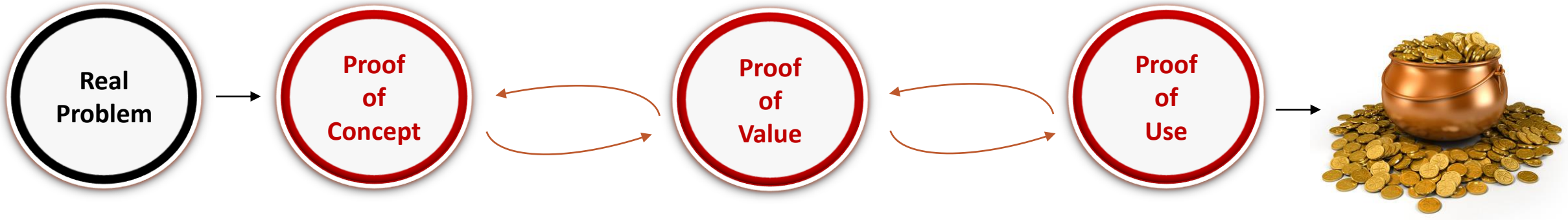
Transition: Research to Commercialization