Towards Social Serious Gaming in the IoT

Concept and prototype development

BY

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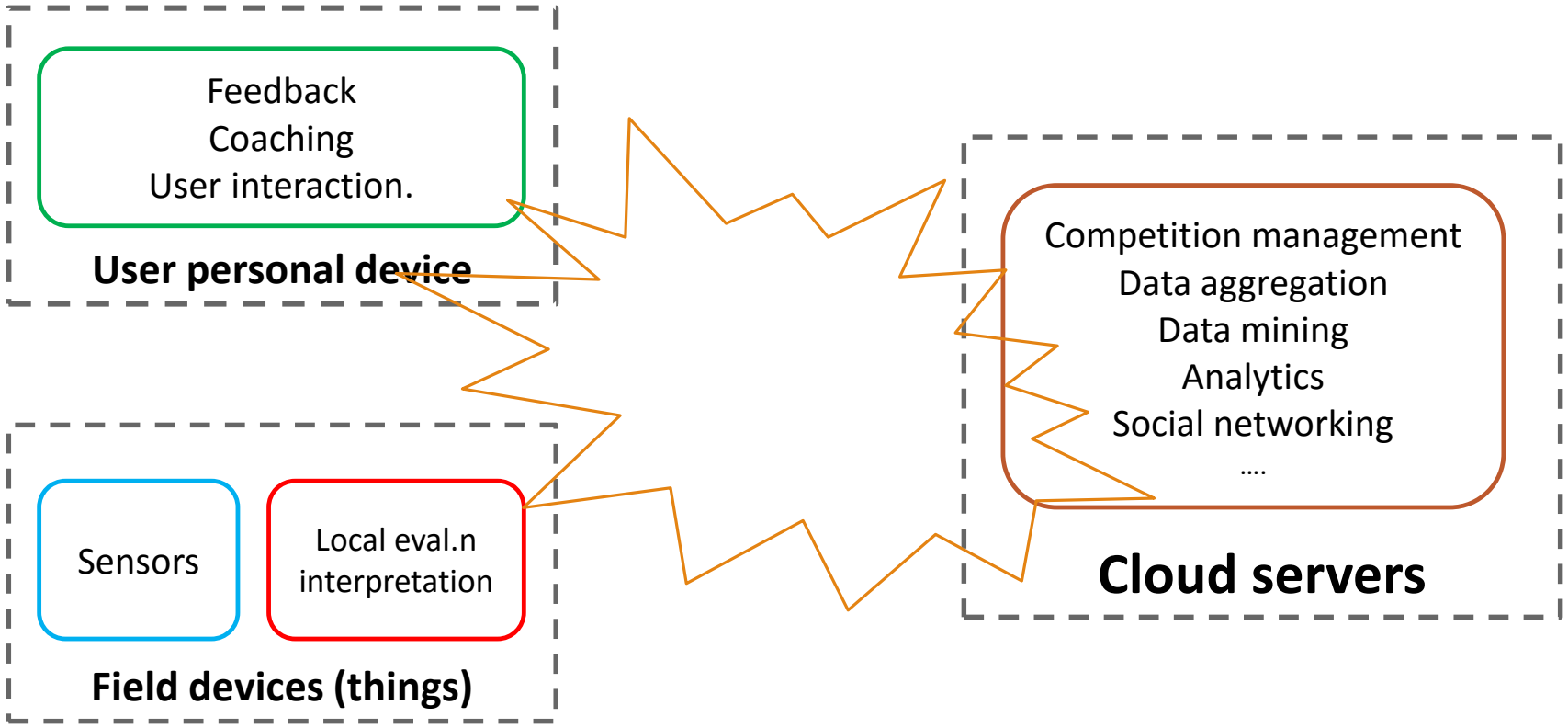
Introduction

- Internet of the Things
  - Distributed sensing, computation and actuation
- Cyberphysical system
  - Digitalization of real-world physical processes
- Cloud computing and Service Oriented Architecture
- Any kind of application domains
- Grand challenge on analytics
  - Descriptive analytics
  - Diagnostic analytics
  - Predictive analytics
  - Prescriptive analytics

IOT Application System Design Process

- Requirement analysis and elicitation from user and market
  - Digitalization of system and processes
  - Huge availability of process data
  - Exploitation for:
    - Instruction and training
    - Performance assessment
    - Coaching
- System architecture
- Implementation
- (User testing)

IoT Social Gaming Platform concept



Application in the Automotive Domain

User interaction
Feedback
Coaching

Personal Info station

TEAM
Tomorrow's Elastic Adaptive Mobility

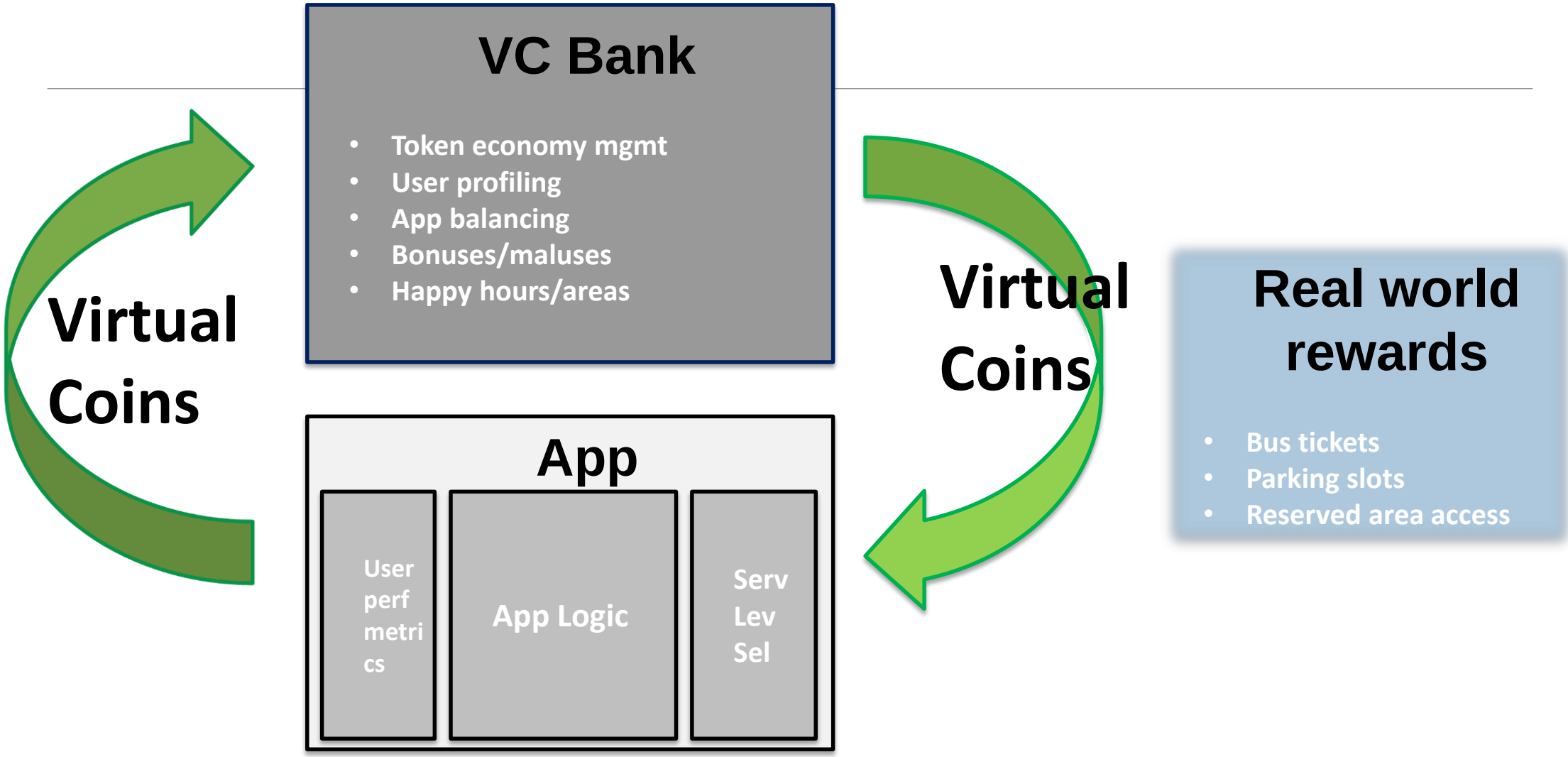
C- Park
CDM
CoNav
G-Drive
C-ACC
PTO

Vehicle Info Station

Virtual Coin management
Competition mgt
Data aggregation
Analytics
Social networking
....

Central Info Station

Social Gaming Services (I)

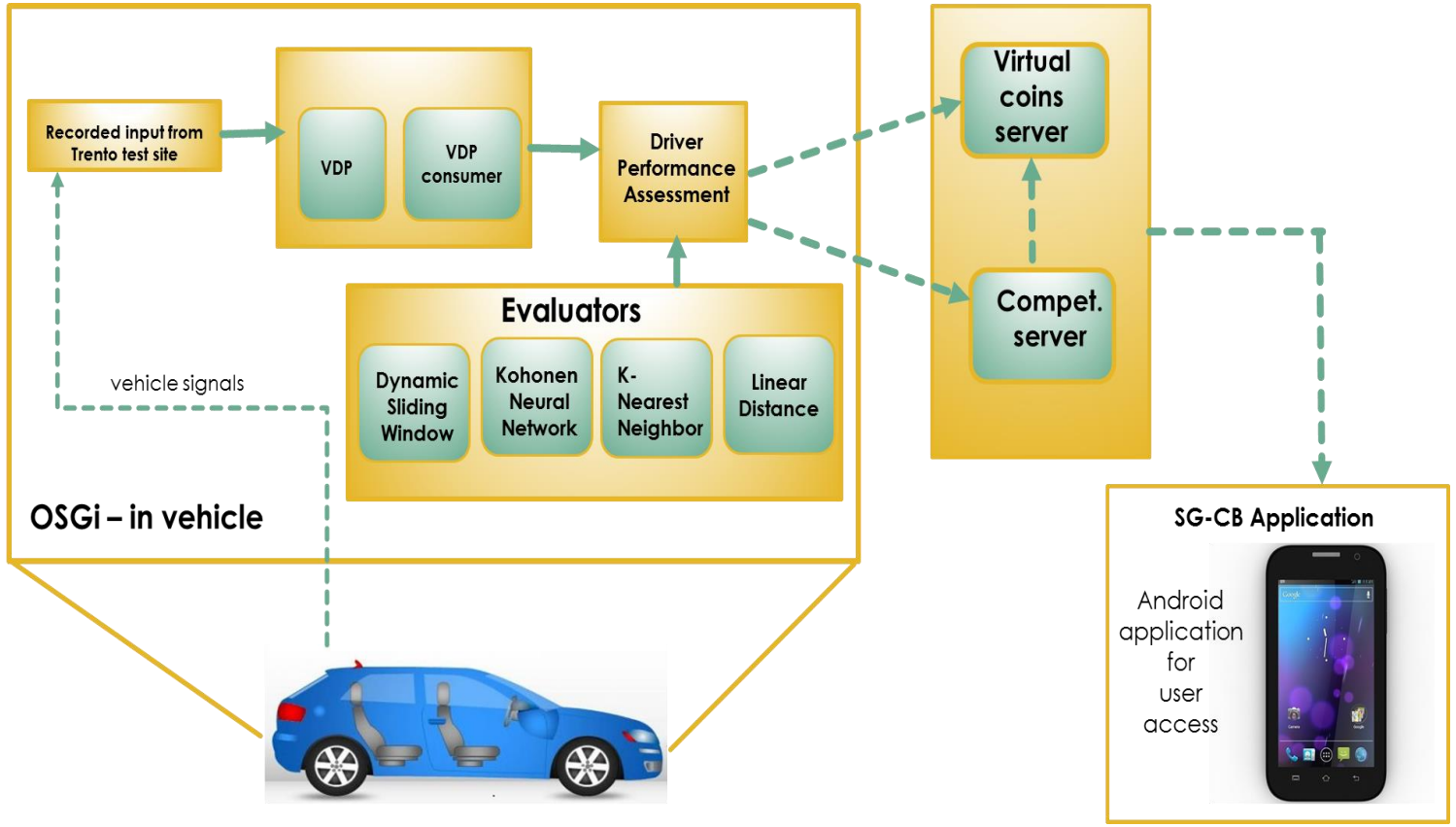


Social gaming services (II)

Competition service

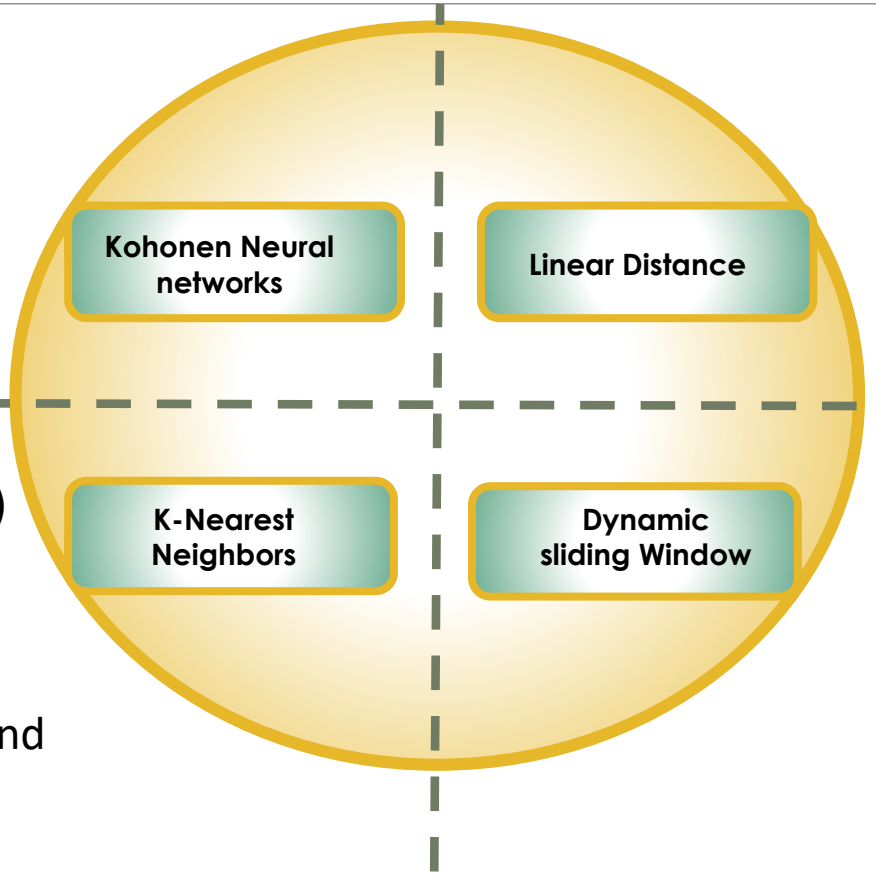
- Self and social comparisons
- Periodic (time and space-based) competitions
- Several different apps can be aggregated in competitions
- Game features (Charts, comparison and ranking, badges)
- Feeds to the VC server

Implemented System Architecture



Algorithms used for evaluation

- Unsupervised learning
- Classification of signal patterns into clusters
- Event-based penalizing criterion
- Batch processing (2-5 minutes)



- Comparison with ideal linear functions (single signals by now)
- Sample by sample evaluation
- Suited for immediate feedback and coaching

- Supervised learning (training set)
- Sample by sample classification
- Combination of signals
- K=1
- Suited for immediate feedback and coaching

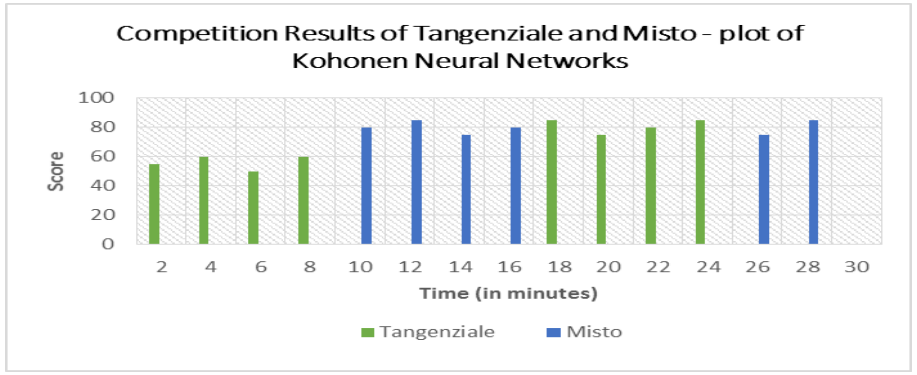
- Recognition of significant windows of signal values
- Detection of events
- Suited for event-based feedback and coaching

Early algorithm tuning tests

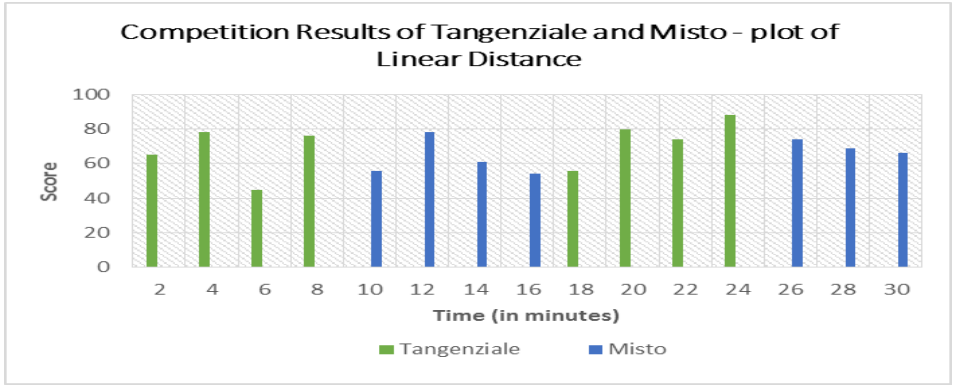
- Vehicular signals gathered by CRF vehicles in Trento
  - Three 20-minute drives
  - Different drivers on the same road

App name	Evaluation algo	Signals evaluated	Signal weights
Green drive 1	Linear distance	Acceleration, RPM, fuel consumption	Equally weighted linear combination
Green drive 2	Kohonen Neural Networks	Acceleration, brake	Equally weighted linear combination
Green drive 3	K-Nearest Neighbors	Speed and brake	-
Green drive 4	Dynamic Sliding Window	Speed	-
Fluid traffic	Linear distance	Speed	-

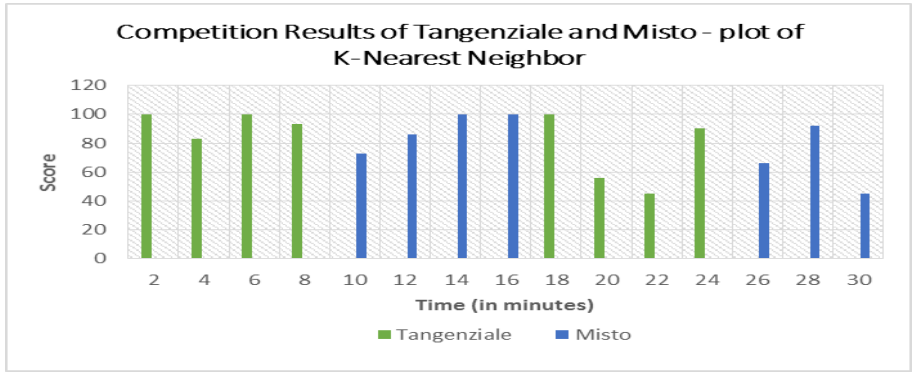
Drive evaluation
(avg values of the algorithms, different inputs)



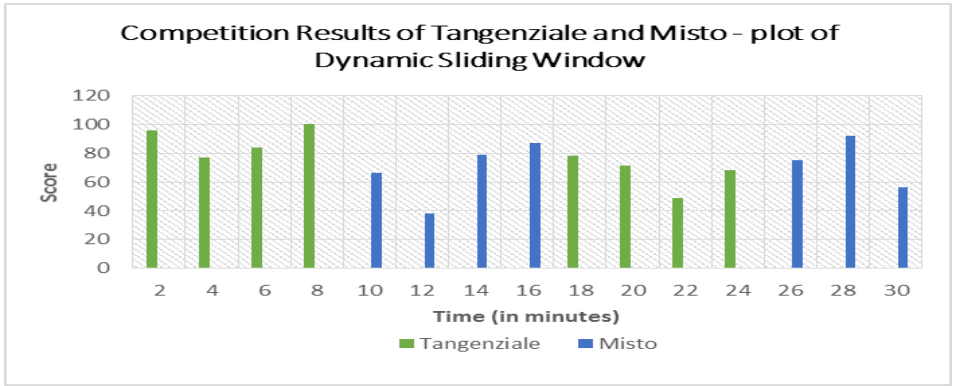
Kohonen Neural Networks



Linear Distance



K-Nearest Neighbors



Dynamic Sliding Window

Preliminary analysis

- The Kohonen Neural Networks tends to penalize minor harsh, suited for personal training (self comparison and improvements)
- K-NN has nominal penalizing criterion in which certain patterns are provided as a sample set to the system and specific harsh patterns are picked up and penalized.
- The Linear distance and sliding windows tend to be subject to noise
  - Need for hysteresis/low pass filetring
- Sliding windows allows detecting events, thus warning the driver at the end of the event
- Importance of processing different signals and target different events and goals

Conclusion and ongoing work

- **Driver assessment**
- Preliminary analysis presented
- Comparison between algorithms with same inputs
- Noise robustness
- More test drives are needed
  - Different vehicles
- Semantic analysis for driver coaching

- **System implementation (Serious Game for Mobility and Transportation)**
- UI on vehicle and smartphone
- Social networking
- Integration of different apps
  - Parking
  - Collaborative Adaptive Cruise Control
  - Collaboratve Navigation
  - Collaborative Driving and Manouvering
  - Public Transport Optimization
- Flexible social gaming platform
  - Service Oriented Architecture
  - Different application domains

Thank you for listening

QUESTIONS?