Tizen apps with Context Awareness & Machine Learning

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Introduction

• Context refers to information that characterizes a situation, between:
  – Apps
  – People
  – Surrounding environment

• Contextual apps are also known as Context aware apps which understand what is going on with and around the user

• Talk to other apps such as social media, email, messages
Introduction

• Context is about knowing the user

• Current location, time, surrounding brightness, user activity, etc

• Context today is being used to simplify the users life, simpler interactions & automatic sensing

• Compare sensors to human senses to understand the world around

• Some contextual experiences:
  • Alarm based on weather & traffic to work by location sensing
  • Phone goes on silent based on proximity to office or a movie theatre
  • Reminders based on travel tickets on email
Introduction

• Lots of new sensors in the user’s smartphone

• Sensors like the accelerometer can give user activity like running or driving

• Combinations of sensors can understand the user better than ever

• More sensors with wearables & other IoTs
Contextual Lifecycle

- Sense, understand and adapt
- Get data from sensors or user social networks
- Build algorithms to understand the data from sensors
- Adapt features & customise UX
Contextual Lifecycle

e.g. Smart ringtone changer
Turns the phone silent in movie theatres

- **Senses** the location of the device
- **Understands** the place by geocoding APIs
- **Adapts** the phone sound profile to silent
Contextual lifecycle

Five technology forces:

• Mobile (extended to Wearables)
• Social Media
• Big data
• Sensors (extended to IoTs)
• Location-based services
Context with Tizen

• Tizen has a large set of in-built context APIs so the apps don’t have to do all the processing on the low level sensor data

• With Tizen 2.3 Activity & Gesture recognition was introduced
  • Recognize & react user activities like walking, running, and in-vehicle
  • Recognize & react to gestures like tap, shake, snap, and tilt
Sensors

- Average mobile device has 7 sensors

- 3 out of 5 human senses have been covered
  - Camera
  - Microphone
  - Capacitive screens

- Sensors can help the app understand the user environment

- Increase the interactive nature of the app
Sensors

- Tizen provides direct access to sensor data through sensor manager class
- The sensor manager class can be polled at intervals by your app
- Poll sensors only as often as required since they consume battery life
Sensors

- Reference: developer.tizen.org/…../sensor_manager.htm
Sensors

- Construct SensorManager Class
- Create a listener
- Add or remove listeners with interval values

```cpp
SensorManager::AddSensorListener()
```

- Poll sensors at intervals
- Receive sensor data from event handlers at polling intervals

```cpp
ISensorEventListener::OnDataRecieved()
```
• Alternative to using sensor manager class is to use:
  • Activity recognition
  • Gesture recognition

• Processed contextual data which will be of better quality
Sensors

Apart from physical sensors, the mobile has lots of user data

• Contact Device API
• Messaging Device API
• CallHistory API
• Context FW

• For example movie tickets, flight tickets or entire vacation itineraries can be parsed through Emails and SMSs’
• Adding a personalized touch of context to your application
Sense

- Extract the power of Social Media and Big Data through social APIs
  - Foursquare Places Explorer
  - Baidu geocoding and reverse geocoding
  - Sina Weibo REST API

Sense the user’s digital life with social APIs
Applying Machine Learning

• ML algorithms learn from and make predictions on data

• ML algorithms work on models have to be made based on sample inputs

• Enables context prediction – which sensor data is more important
Applying Machine Learning

• Using a combination of sensors, Machine Learning models can be used to determine user activity

• Extract sensor data and train ML models

• Multiple context data used together can give more specific information about user

• E.g. Accelerometer & Barometer can be used together to detect walking vs cycling
Applying Machine Learning

- ML algorithms make sense of noisy/conflicting data from sensors
- Large datasets are useful to train & fine tune Machine Learning models
- ML algorithms use raw sensor data to churn out signals like high level activities
Case Study

• Launchify - Contextual app shortcuts app by Emberify

• Context triggers
  • Time
  • Location

• The app tracks when and where the user uses which apps

• According to that makes predictions of which app the user needs right now

• Recommends top six apps as a widget
Case Study

- Contextual app shortcuts by Emberify
- To sense it uses geofences for home & work in addition to time
- This data is stored in a SQLite database
- Depending on the current context it studies previous trends of apps based on the place and time
- Adapts the algorithm based on which point of context is more relevant for the user
- Based on this it predicts which top 6 apps the user might use

Learning from data and making predictions on data
Experiences

• What I have learnt from while building context aware systems:
  • Some common sense assumptions are needed in addition to the sensor data based on general human behavior to get more accuracy
  • Sometimes sensors can give us conflicting data
  • Use multiple sensors to confirm it
  • Common sense logic can be applied to the algorithm like repeating of a certain event occurrence before counting it since it can even be a random event
Use Cases

• Simplifying UX
  • Action based on activity or event

• Lifelogging
  • Automatic Tracking
  • Quantified Self
  • Personal Analytics

• Smart Recommendations
  • Personalized discovery
Use Cases

- Current apps can be re-imagined by adding context to them
- Things will be more automatic and seamless for users
- A more personal touch will be provided by adding the contextual fabric
- New value propositions for the users offering developers a new market
Design

• New UI/UX with contextual experiences

• App UI is getting less important and smart notifications is the new interface

• Information as a widget or notification

• Apps like Foursquare provide you the information when you need it

• Eg. Tips when you reach a restaurant
Design

- Contextual Notification becoming a priority while designing for the wrist
- Low screen estate
- Minimal interaction
- Input methods are limited
- Making it perfect for contextual experiences
Design

• Context to customize user experience

• Adaptive UI/UX

• Based on environmental conditions

• Examples of adaptive user experiences:
  • Dark/Light theme based on ambient light sensor
  • Media volume based on sound in environment based on microphone
  • UI according to orientation
Wow factor

- Wow factor in apps like Foursquare
- Automatically knows which restaurant the user is at and provides recommendations
- High utility features been triggered automatically through contextual triggers
- Ideal contextual experience
Privacy limitations

- Some apps are going over the freaky line
- Making users nervous with their personal information
- For example Nokia’s Trapster allows the user’s location to be stalked precisely
- System lacking privacy
- Disclose information with a privacy policy
- Should be allowed to disable the service
- Encryption & security protocols if data is being stored or processed on a server
Battery limitations

- Data should be polled only when required
- Low battery sensor polling should stop or be reduced
- Share data between apps
- Rather than going to the sensor every time it would be more efficient to get data through an app that just polled the data
- E.g. Use location from cellular towers rather than GPS is accuracy isn’t that important
Other Limitations

- Machine learning algorithms aren’t perfect
- Location has inaccuracy based on GPS sensor
- Allow the user to correct or a manual method of insertion
- E.g. Slow driving can be confused as cycling
Tizen 2.4

• New context with Tizen 2.4b
  
  • Maps Service with geocoding, place discovery & routes
  
  • Context FW
  • Context-aware app-launching and notification rules, based on time, several device status and events, and communication events.
  • Contextual History APIs have been added for getting device usage statistics, eg. Which app the user uses the most
  
  • Geofence Manager
Tizen 2.4

• Ideas
  • Contextual reminders app using places instead of time
  • Application stats for Quantified Self apps
  • Interactive games based on location
Future

- IoTs are bringing in new ways sense the user’s environment
- With smart cars & smart homes we can get more information about the user
- Apps that use context will be automatic and seamless with more sensor data
- Headless apps – Running in the background, minimal user interaction
Questions
Thank You

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