Using contextual information to recognize users activities in urban environments for adapted service provisions

By Charles Gouin-Vallerand, Associate Professor in Computer Science @ TELUQ University & Director of the LICEF research center
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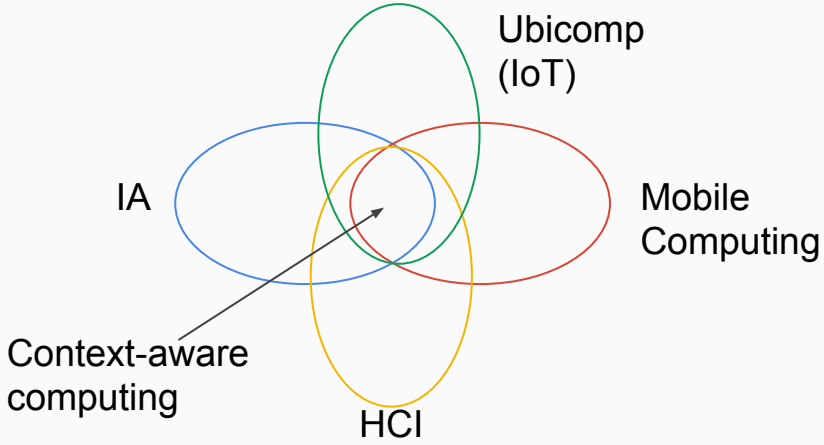
TÉLUQ LICEF

Researcher profile

- Human-Computer Interaction
  - Keywords : Context-aware computing, Ubiquitous Computing, Mobile computing and Augmented Reality
  - Fields of application : Smart cities, Gerontechnologies, ADL assistance, driving assistance/HCI



Activity recognition in urban environments

Goals:

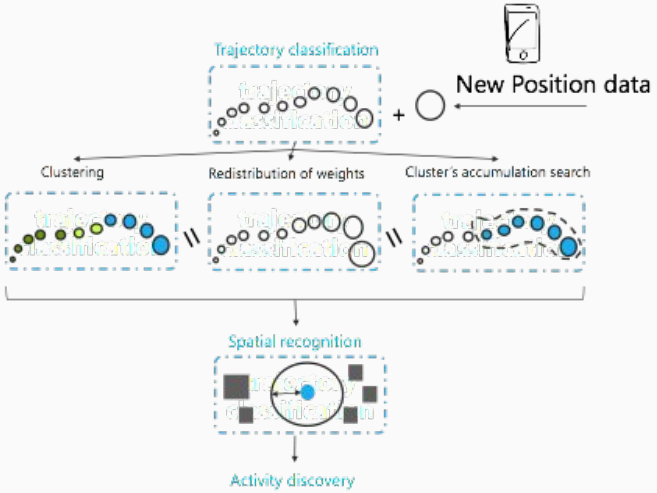
- Use GPS traces and geospatial databases to infer & predict user's activities
- Online inference and prediction, more or less in real time & on mobile devices
- Activity recognition system must be battery-aware and adapt its energy consumption

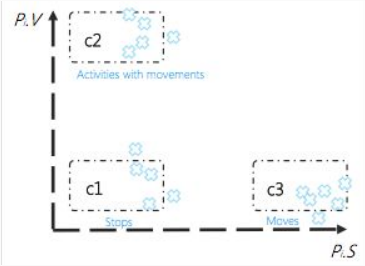
Challenges :

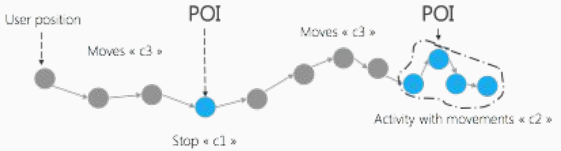
- Limited resources (CPU, RAM, battery, 3-4G)
- Several types of activity (transportation, activity in mobility, non-moving activity)
- Use only GPS traces

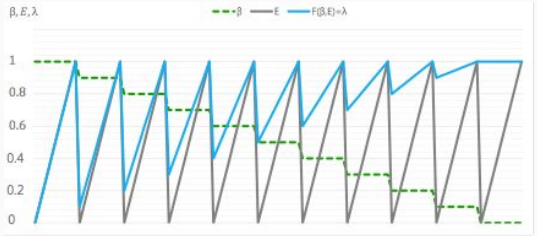
Activity recognition in urban environments

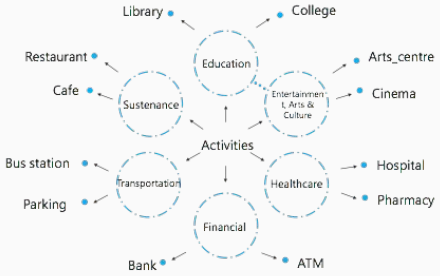
Process :











Activity recognition in urban environments

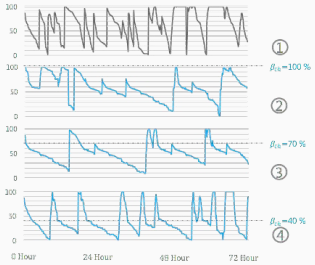
Our approach vs. CB-SMoT (Zhao Xiu-Li & Xu Wei-Xiang, 2009)

Family Activity Coordination Dataset from HCII, CMU

	Our approach	CB-SMoT V1 *MinTime*=90s	CB-SMoT V2 *MinTime*=180s	CB-SMoT V2 *MinTime*=500s
Tested activities	10525	10525	10525	10525
Correct	8313	4028	7157	8257
Missed	1812	6497	3368	2268
False	578	181	909	2789
Accuracy	78%	38%	68%	78%
Error	22%	63%	40%	48%

Our approach vs. LifeMap (Seoul dataset)

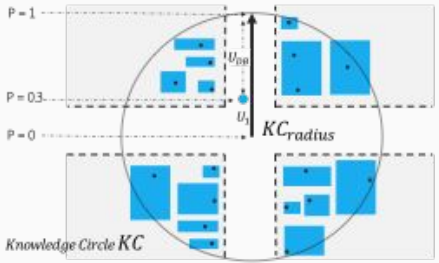
	β_{th} = 100%	β_{th} = 70%	β_{th} = 40%	LifeMap
Accuracy	68,7 %	77,1 %	85,4 %	78%

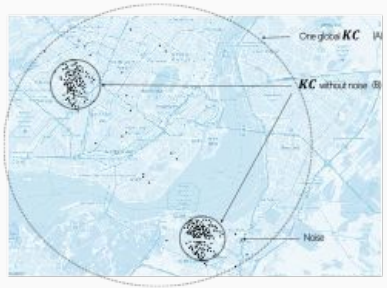


Bluetooth Low Energy Based System for Spatial Exploration in Smart Cities

Process:

1. Collect contextual data from iBeacons with smart phones
2. Build Knowledge zone (KC) from collected data with a KC radius quotient
3. Share collected data with other users based on the KC quotient





Research team

7+ publications, with :

- Boukhechba, M.; Bouzouane, A.; Gaboury, S.; Gouin-Vallerand, C.; Giroux, S. et Bouchard, B. (2017). A novel Bluetooth Low Energy Based System for Spatial Exploration in Smart Cities. Expert Systems with Applications, 77 (C), 71-82.
- Boukhechba, M.; Bouzouane, A.; Gaboury, S.; Gouin-Vallerand, C.; Giroux, S. et Bouchard, B. (2017) Prediction of next destinations from irregular patterns, Journal of Ambient Intelligence and Humanized Computing, Elsevier

Research team :

- Mehdi Boukhechba - Ph.D. student UQAC- TÉLUQ (2014-2016), now postdoc at UofVirginia
- Collaborators : Prof. Abdenour Bouzouane, Prof. Sébastien Gaboury and Prof. Bruno Bouchard of UQAC, Prof. Sylvain Giroux of Université de Sherbrooke

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Other work in context-awareness & urban environment

- Activity prediction : Recognizing user's habits with data drift
  - Boukhechba, Mehdi; Bouzouane, Abdenour; Bouchard, Bruno; Gouin-Vallerand, Charles, & Giroux, Sylvain (2015). Online Prediction of People's Next Point-of-Interest: Concept Drift Support. In Proceedings of the 6th International Workshop on Human Behavior Understanding (HBU 2015, Osaka, Japan, September 8) (p. 97-116). Springer, coll. « Lecture Notes in Computer Science 9277 »

- Detection of driving fatigue and assistance to senior drivers
  - Perrine Ruer, Charles Gouin-Vallerand and Evelyne Vallières, "Persuasive strategies to improve driving behavior of elderly drivers by a feedback approach", Proceeding of the International Conference on Persuasive Technologies (Persuasive 2016), Salzburgh, Austria, 2016.

- Mobile Cognitive Orthesis with Augmented reality : assistance to the ADL
  - Damien Brun, Charles Gouin-Vallerand, and Sébastien George. 2017. Augmented human mind: case of reasoning. In Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers (UbiComp '17).
  - Brun, Damien; Ferreira, Susan; Gouin-Vallerand, Charles et George, Sébastien (2017). A mobile platform for controlling and interacting with a Do-It-Yourself Smart Eyewear. International Journal of Pervasive Computing and Communications, 13 (1).

Thank you for your attention

Questions ?

Research projects supported by: