

Reducing Distraction of Smartwatch Users with Deep Learning

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Crucial Issue for Smartwatch Users

- The smartwatch allows us to be aware of newly available notifications in real-time.
- But, users confront a huge variety of notifications.
 - SNS events (new post and location checkout), new application updates, won badges, or reminders.



Goal

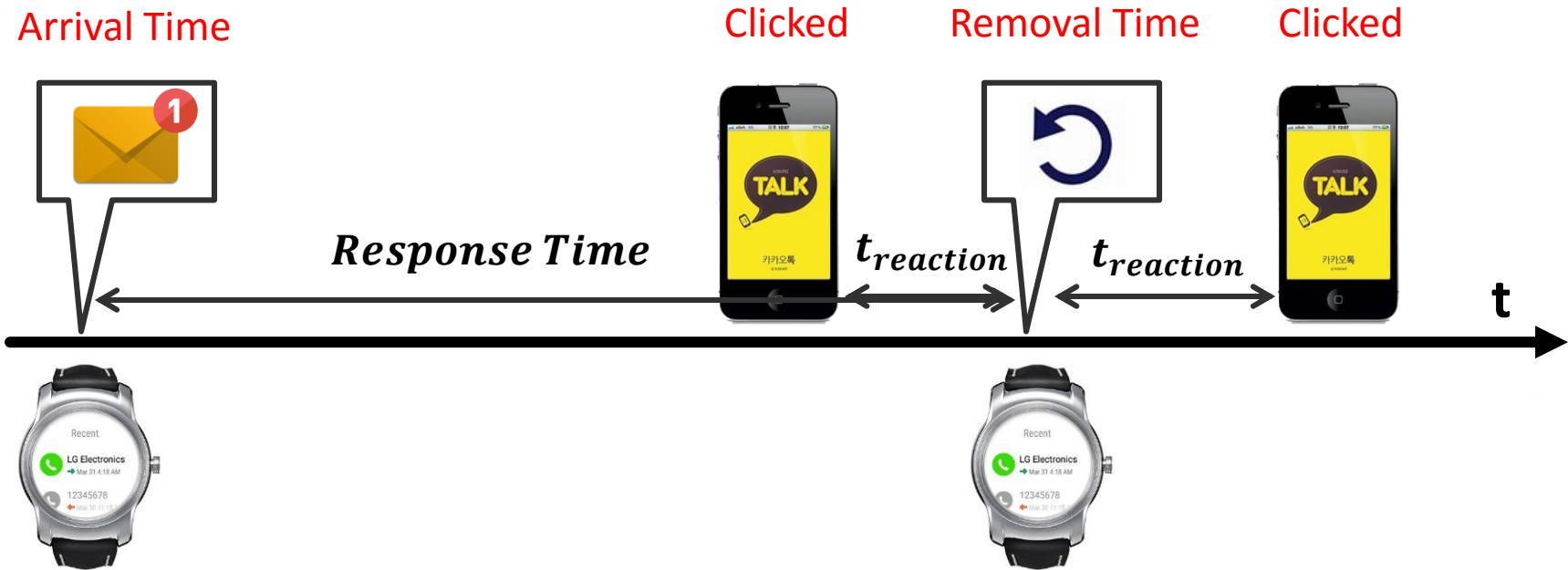
- Design a system for intelligent notification delivery between smartphone and smartwatch.
- Define a important notification from real usage data and prior assumption.
- Build machine learning model and then deliver only a important notification to a smartwatch from a smartphone.

Definition of Important notification

- From prior research's results [Mehrotra et al. UbiComp'15], we assume that a important notification meets the following conditions:
- It triggers application launch to take further actions.
- The notification is reacted within 10 minutes.

Unobtrusive Detection

- Response Time = Removal Time – Arrival Time
- Response Time < 10minutes
- Check whether the application was launched.



Data Collection

- Develop nCollector that can unobtrusively capture the notification labels and context data.
- LG Urbane W 150.
- Participants:3 (no monetary incentive)
 - 2 male and 1 female with the age span between 25 and 35 years.
- Collect total 6,491 notifications.
- Duration: 4 weeks on average.

nCollector Dataset



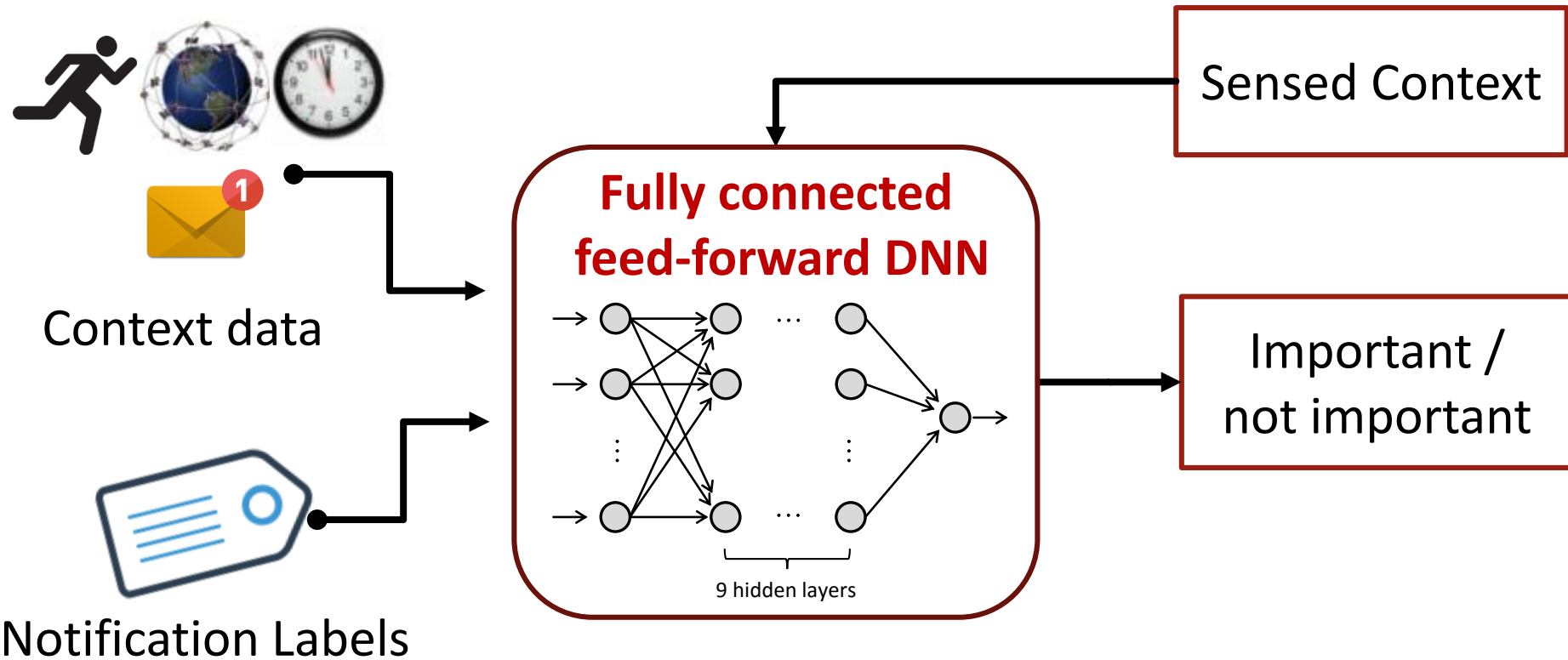
User	Periods	# of Noti.
A	45	578
B	32	1717
C	33	4196

Extracting Features

- Notification label: IsImportant = {TRUE, FALSE}
- Extract 8 features by using R caret package.
 - Sender application name
 - Notification Priority
 - Notification Title
 - Physical Activities: InVehicle, OnDicycle, OnFoot, Running, Still, Tilting, Walking, and Unknown
 - Time of day
 - Day of the week
 - Recent Phone Usage
 - Proximity

Important Notification Prediction

- **Hypothesis:** sensed context can identify the important notification.
- Training DNN with [TensorFlow \(Supervised Learning\)](#)



Prediction Results

- Split data into two sets: training(70%) and testing (30%).

User	Precision	Recall
A	71%	65%
B	61%	51%
C	90%	99%

- Users can check all the notifications on the smartphone.
- User B shows the worst precision and recall.
 - Using an desktop PC, rather than mobile devices.

Limitations and Discussion

- Unobtrusive detection is root cause of low accuracy.
- Some notifications were misclassified as unimportant notifications.
 - Users can attend on another device.
 - Users can just read and dismiss notifications because notifications do not require further actions.
- Poor accuracy of prediction model.
 - The prediction model is trained by means of misclassified notification label.

Thank You

Questions?

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