"Community Imaging" techniques:

Understanding people through their use of technology

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Advanced evaluation techniques

- How to measure performance of
 - large numbers of people
 - from remote settings (e.g. online, distributed)
 - using large datasets
- We want to determine
 - What happened / what did people do?
 - What does it mean?
 - What does it tell us about people?
- "Community Imaging"
 - Understanding people through their use of technology.









Smartphones

Online behaviour

Human Computation & Crowdsourcing



Do phones create habbits?



We built an app and deployed to an appstore. The app collects data.







Differences in launching



Y-axis is LOGARITHMIC!



Histograms per user





Patterns emerge (users)





Histograms per app





Patterns emerge (apps)

Cluster	Description	Centroid	Example Apps	Cluster Size
Label		Revisitation Curve		(# Apps)
F1	Fast		Google Play Store, Facebook Messenger, InoReader, Chrome Beta, BlackBerry Messenger, Reddit, Okcupid	32 (13%)
F2	Fast	\sim	Chrome, Whatsapp, Facebook, Google Hangouts, SMS/MMS, Viber, Youtube, Contacts+, Google Maps, Firefox, Spotify, Skype, Snapchat, Xperia Conversations, Line, Reddit News, Telegram Messenger, Music, Falcon Pro	82 (33%)
M1	Medium	~~~	Phone, Gmail, Contacts, Email, Dialer, Clash of Clans, Instagram, Outlook, Yahoo Mail, Opera Browser	47 (19%)
S 1	Slow	$\sim \sim \sim$	Gallery 3D, Calendar, Camera, Twitter, Calculator, Clean Master (Speed Booster) Runkeeper Pro, Flipboard, Google Play Services, Mobile Bank, Mobile Weather, Flickr, Google Doc Editor, Tumblr, Quick Office, Google Translate	30 (12%)
S2	Slow	$\sim \land$	Settings, Desk Clock, Organiser, Tinder, Plants vs. Zombies 2, Clash of Lords, Titanium Backup, Hot or Not, Control Panel, Candy Crush Saga, Castle Clash	40 (16%)
H1	Hybrid	$\sim \sim$	Evernote, Google+, Google Docs, MusicBox, Adobe Reader, 9gag, Video Player, Meo Remote, Waze, Dictionary, Opera Mini	21 (8%)



Compare to Web revisitaton (2000's)

Cluster Group	Centroid Curve	Description	Corresponding cluster group descriptions from Adar <i>et al.</i> [1]
Fast (F1,F2) Medium (M1)	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Instant Messaging, Browser, Social Media Email and Phone Communication	Hub & Spoke, Shopping & Reference, Auto refresh, Fast monitoring, Pornography & Spam. Popular homepages, Communication, .edu domain.
Slow (S1,S2)		Utilities, Multimedia, Health and Fitness, Games, Dating, Phone Settings	browser homepages. Entry pages, Weekend activity, Search engines used for Revisitation, Child-oriented content, Software updates
Hybrid (H1)	\sim	Documents, Notes, Video, Satnav	Popular but infrequently used, Entertainment & Hobbies, Combined Fast & Slow.

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Similar patterns. What does this mean?

Do phones create habbits?





Online behaviour is a proxy



Can online behaviour be used as a proxy for studying urban mobility?



WiFi access points







Across oulu – 3 years



Upward trend. Needs normalisation.





Notice that the y-axis is now 0~1



Each location has a pattern





Google web searches also have a pattern





"Google Trends" lets us match the patterns



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Which keyword patterns match to a location patterns?

University	r-value
Helka (Helsinki university library)	0.914
google scholar	0.895
scholar	0.894
tutkimus (research)	0.893
learning	0.887
optima oulu (student environment)	0.878
funktio (function)	0.876
luento (lecture)	0.874
development	0.872
nelli (university e-library portal)	0.871



Which keyword patterns match to a location patterns?

Ice hockey hall	r-value
sjl (Finnish ice hockey union)	0.726
finnhockey	0.724
keilahalli (bowling hall)	0.722
kiekko kaleva (hockey in local newspaper)	0.716
sm-liiga nelonen (tv-channel with hockey)	0.715
nelonen sm (same as above)	0.713
jääkiekkoliitto (ice hockey union)	0.711
nelonen sm liiga (tv-channel, ice hockey)	0.707
lihapata (meat stew)	0.699
finhockey	0.699



Which keyword patterns match to a location patterns?

High school	r-value
wilma kempele (student environment)	0.795
wilma kiiminki (student environment)	0.791
helmi (student management system)	0.781
wilma oulu (student environment)	0.771
edu (news and info on education)	0.763
wilma kuusamo (student environment)	0.758
pedanet (support for online learning)	0.747
wilma raahe (student environment)	0.744
wilma kemi (student environment)	0.736
varoitusmerkit (warning signs)	0.726



Similar patterns. What does this mean?





Human Computation & Crowdsourcing

Can we use humans to solve problems that are hard for computers?



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Offer decision-support to humans (not answers)



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Which car should I buy?

	Price		
Volvo			





Things to evaluate

- Is a solution "good"? (BMW, Mercedes, Donkey)
- Is a criterion "good"? (Price, Safety, Swag)
- Is the decision-support system "good"?





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Generally, how pleasant is the weather. Choose 0 for a really bad weather, 10 for great weather all year round!



Smart City research

- Brings together
 - Large numbers of people/users
 - Large volumes of data
 - Large number of disciplines
- Provides a natural
 - Metaphor for computation (4th wave of computing)
 - Application domain for interesting problems/solutions



The end

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