

Opportunities & Challenges in Personalised Travel

@neal_lathia, @CodeVoyagers

Workshop on Recommenders in Tourism



Today

1. Background
2. Example: Urban Travel
3. Example: Inter-City Travel
4. Challenges Ahead

(1) Background

Online vs. Offline

Playlists Made Just For You



Discover Weekly
Your weekly mixtape of fresh music.
Enjoy new discoveries and deep cuts...
PLAYLIST • BY SPOTIFY



Release Radar
Never miss a new release! Catch all
the latest music from artists you care...
PLAYLIST • BY SPOTIFY

Top Recommendations For You



84% 14:53

Search

Quora

Ask

Feed

Bookmarks

New Questions

NEW QUESTIONS TO FOLLOW

What is Neighborhood Aggregation in Spark?


Follow

Do we need Spark app

Follow

See more in New Questions to Follow

DISCOVER NEW PEOPLE




Elizabeth H. Simmons

Physics Professor, Dean, and Associate Provost ...

Follow

25.9k



Jeff Erickson

CS professor, University of Illinois at Urbana-...

Follow

10.4k

Home

Answer

Notifications

You

85% 14:50

Skyscanner Eng

1,422 Tweets


Tweets

Tweets & replies

Media

Likes

Who to follow




Tech Meetup

@techmeetup

Beer, pizza, and tech talks at monthly meetups.

Follow




Scottish Developers

@scottishdevs

A user group of software developers in Scotland.

Follow



Sarah Hale


@sarahjane_hale

Words about Stuff. Developer.

Follow

Show more

Skyscanner Eng retweeted



Lorraine Rew @lorrainerew · 17 A

What mobile engineering problem would you like to solve @Skyscanner?


Join us at [#travelersmobile](https://bit.ly/2wds927)

86% 14:44

amazon.co.uk


What are you looking for?

Your recommendations




Gateway (S.F. MASTERWORKS)

£9.98



Mona Lisa Overdrive (The Neuromancer Trilogy)

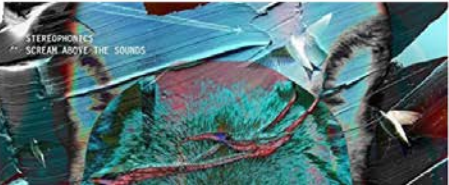
£8.99



Count Zero (The Neuromancer Trilogy)

£8.99

See more



Online

Situation

Information *Overload*

Goal

Relevance

Solution

Recommendation

Effect

Unique Experiences

Suggested

Milano-LIN •

102 cal 123 min

 •  • 

Every 30 min from Aeroporto di Linate

Milano-LIN •  •

115 cal 129 min



Every 30 min from Aeroporto di Linate

Milano-LIN •  •

115 cal 129 min



Every 30 min from Aeroporto di Linate

 •  •  • 

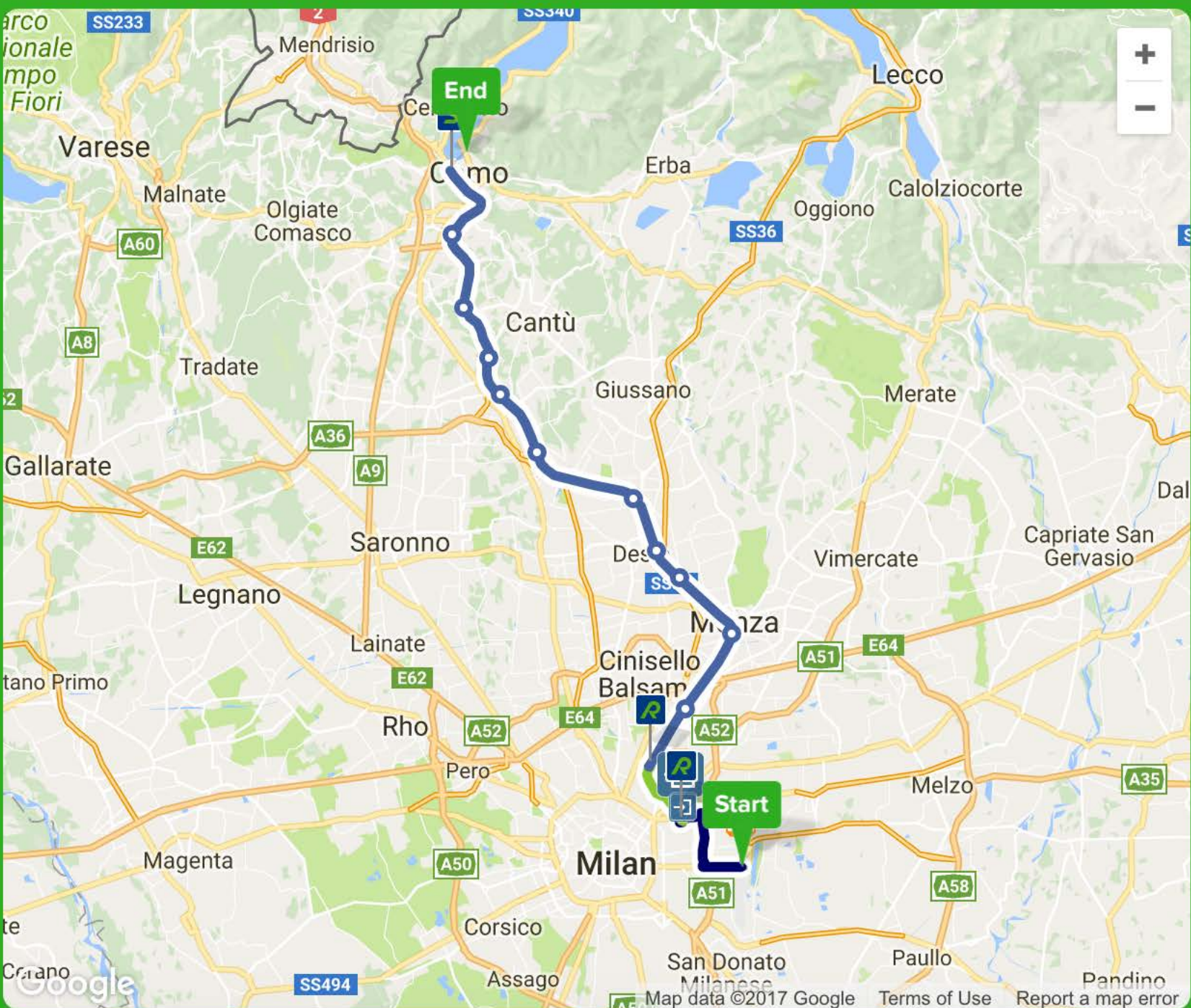
108 cal 129 min

Every 6 min from Aeroporto di Linate

 •  •  • 

131 cal 130 min

Every 5 min from V.le Forlanini Via Circonv...



Departure times



Outbound
00:00 – 23:59



Return
00:00 – 23:59



Journey duration



2 hours – 24.5 hours



Airlines



Select all | Clear all

oneworld

SkyTeam



18:35
LHR

14h 40
1 stop AMS

10:15⁽⁺¹⁾
LIN



20:40
LIN

23h 40
1 stop CDG

19:20⁽⁺¹⁾
LHR

4 deals from
£280

Select →



21:00
LHR

12h 15
1 stop AMS

10:15⁽⁺¹⁾
LIN



20:40
LIN

22h 50
1 stop CDG

18:30⁽⁺¹⁾
LHR

1 deal
£294

Select →



21:00
LHR

12h 15
1 stop AMS

10:15⁽⁺¹⁾
LIN

2 deals from
£298

Select →

Online

Situation

Information *Complexity*

Goal

Trip Planning

Solution

Cheapest, Fastest

Effect

'Intelligent Calculators'

Recurring
Question

Can we do better?

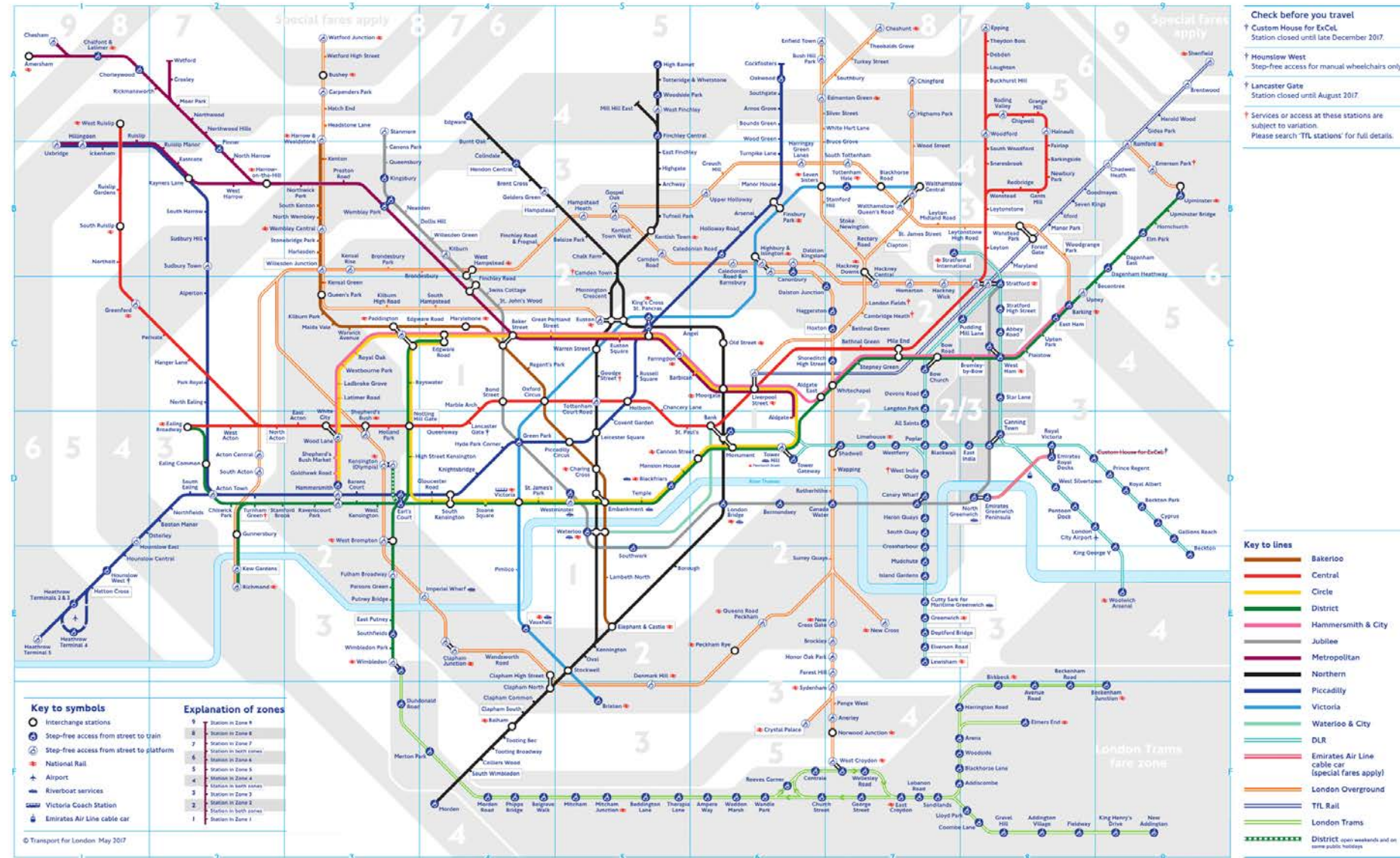
(2) Urban Travel

N. Lathia, L. Capra. Mining Mobility Data to Minimise Travellers' Spending on Public Transport. ACM KDD 2014.



UCL

Tube map



Tube map



MAYOR OF LONDON

Adult rate prices: All Tube, DLR, London Overground and TfL Rail services and National Rail services in

Zone	Pay as you go			Travelcards			
	Caps			Day Anytime	Day Off-peak	7 Day	Mo
	Daily Anytime	Daily Off-peak	Monday to Sunday (contactless only)				
Zone 1 only	£6.60	£6.60	£33.00	£12.30	£12.30	£33.00	£12
Zones 1-2	£6.60	£6.60	£33.00	£12.30	£12.30	£33.00	£12
Zones 1-3	£7.70	£7.70	£38.70	£12.30	£12.30	£38.70	£14
Zones 1-4	£9.50	£9.50	£47.30	£12.30	£12.30	£47.30	£18
Zones 1-5	£11.20	£11.20	£56.20	£17.50	£12.30	£56.20	£21
Zones 1-6	£12.00	£12.00	£60.20	£17.50	£12.30	£60.20	£23
Zones 1-7	£13.00	£12.10	£65.40	£22.10	£13.10	£65.40	£25
Zones 1-8	£15.50	£12.10	£77.30	£22.10	£13.10	£77.30	£29
Zones 1-9	£17.20	£12.10	£85.70	£22.10	£13.10	£85.70	£32
Zones 1-9 + Watford Junction	£23.00	£17.50	£86.10	£23.00	£17.50	£86.10	£33
Zones 1-9 + Shenfield	£28.60	£19.30	£102.20	£28.60	£19.30	£102.20	£39
Zone 2 only	£6.60	£6.60	£24.70	£12.30	£12.30	£24.70	£9
Zones 2-3	£7.70	£7.70	£24.70	£12.30	£12.30	£24.70	£9
Zones 2-4	£9.50	£9.50	£27.30	£12.30	£12.30	£27.30	£10
Zones 2-5	£11.20	£11.20	£32.80	£17.50	£12.30	£32.80	£12
Zones 2-6	£12.00	£12.00	£41.20	£17.50	£12.30	£41.20	£15
Zones 2-7	£13.00	£12.10	£42.70	£22.10	£13.10	£42.70	£16
Zones 2-8	£15.50	£12.10	£58.10	£22.10	£13.10	£58.10	£22
Zones 2-9	£17.20	£12.10	£58.10	£22.10	£13.10	£58.10	£22
Zones 2-9 + Watford Junction	£23.00	£17.50	£58.10	£23.00	£17.50	£58.10	£22
Zones 2-9 + Shenfield	£28.60	£19.30	£77.60	£28.60	£19.30	£77.60	£29
Zone 3 only	£7.70	£7.70	£24.70	£12.30	£12.30	£24.70	£9
Zones 3-4	£9.50	£9.50	£24.70	£12.30	£12.30	£24.70	£9
Zones 3-5	£11.20	£11.20	£27.30	£17.50	£12.30	£27.30	£10
Zones 3-6	£12.00	£12.00	£32.80	£17.50	£12.30	£32.80	£12
Zones 3-7	£13.00	£12.10	£42.70	£22.10	£13.10	£42.70	£16
Zones 3-8	£15.50	£12.10	£58.10	£22.10	£13.10	£58.10	£22

Segments

Uxbridge Underground Station 

Euston Square Underground Station 

Adult 

Show single fares

Fares between two stations may vary depending on the direction of travel, time of day and day of the week.

Single fare finder only shows the cost of a single rail journey. Our [fares tables](#) show the price of caps, Travelcards and fares on buses and trams.

Fares



Oyster

Peak : £5.10

Monday to Friday from 0630 to 0930.



Contactless

Off Peak: £3.10

At all other times including public holidays.



Cash

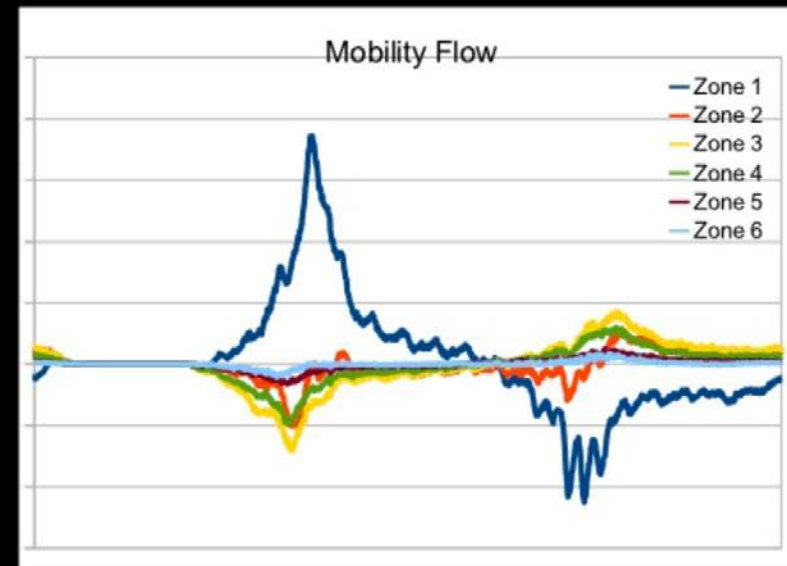
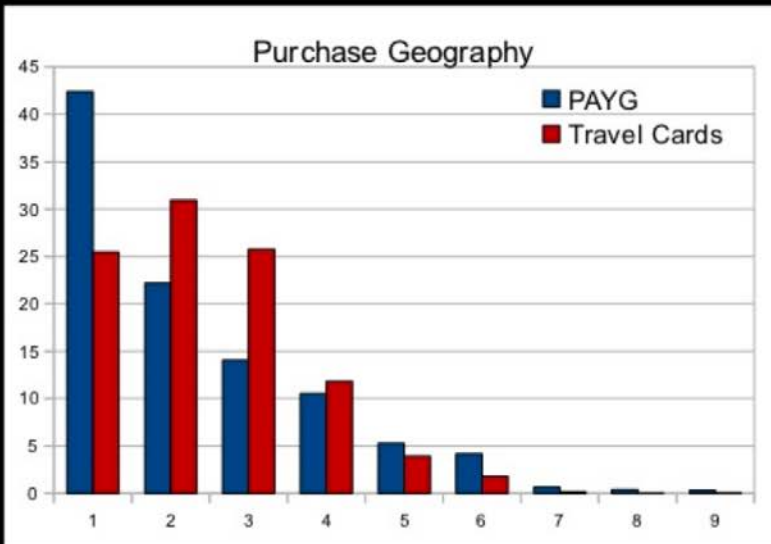
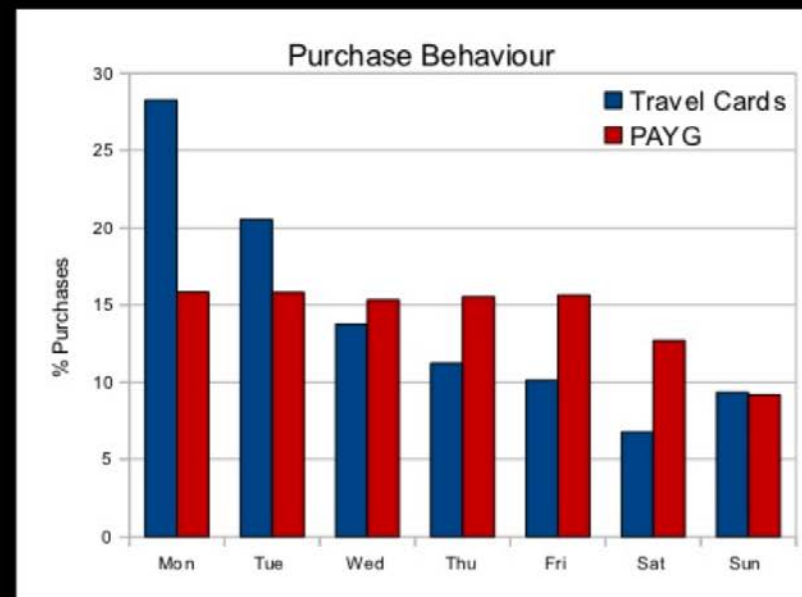
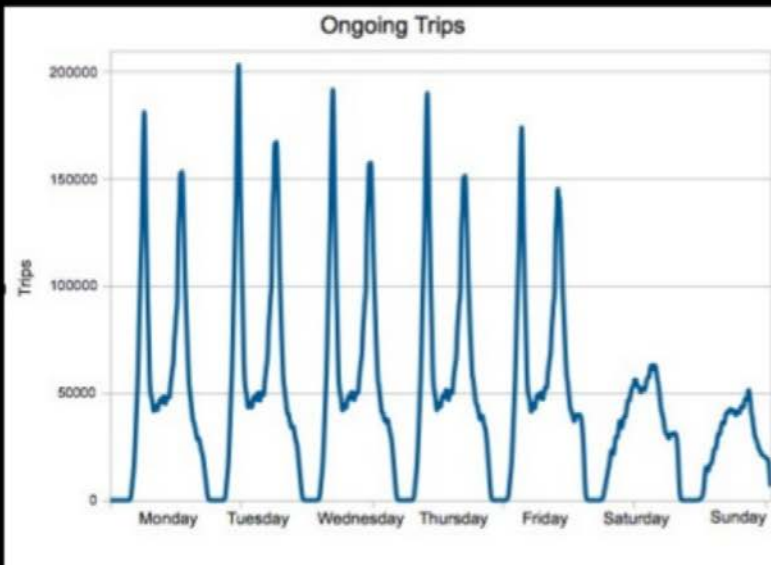
£6.00

At any time.



Can we do
better?

By predicting your travel?
By recommending a fare?



classification accuracy

0.0 (worst)

...

77% everyone on pay as you go

80% naïve bayes

...

97% (“people like you should have bought...”)

98% decision trees

100% (oracle)



(3) Inter-City Travel

Building machine learning-driven products at Skyscanner





[Recent searches](#) [Help](#)

en-GB £ GBP

[Log in](#)

Flights

Hotels

Car Hire

Flight + Hotel

☒ Return ☐ One way ☐ Multi-city

[Map](#)

From	To	Depart	Return	Cabin Class & Travellers
London City (LCY)	<i>Country, city or airport</i>	25/04/2017	25/04/2017	1 adult, Economy

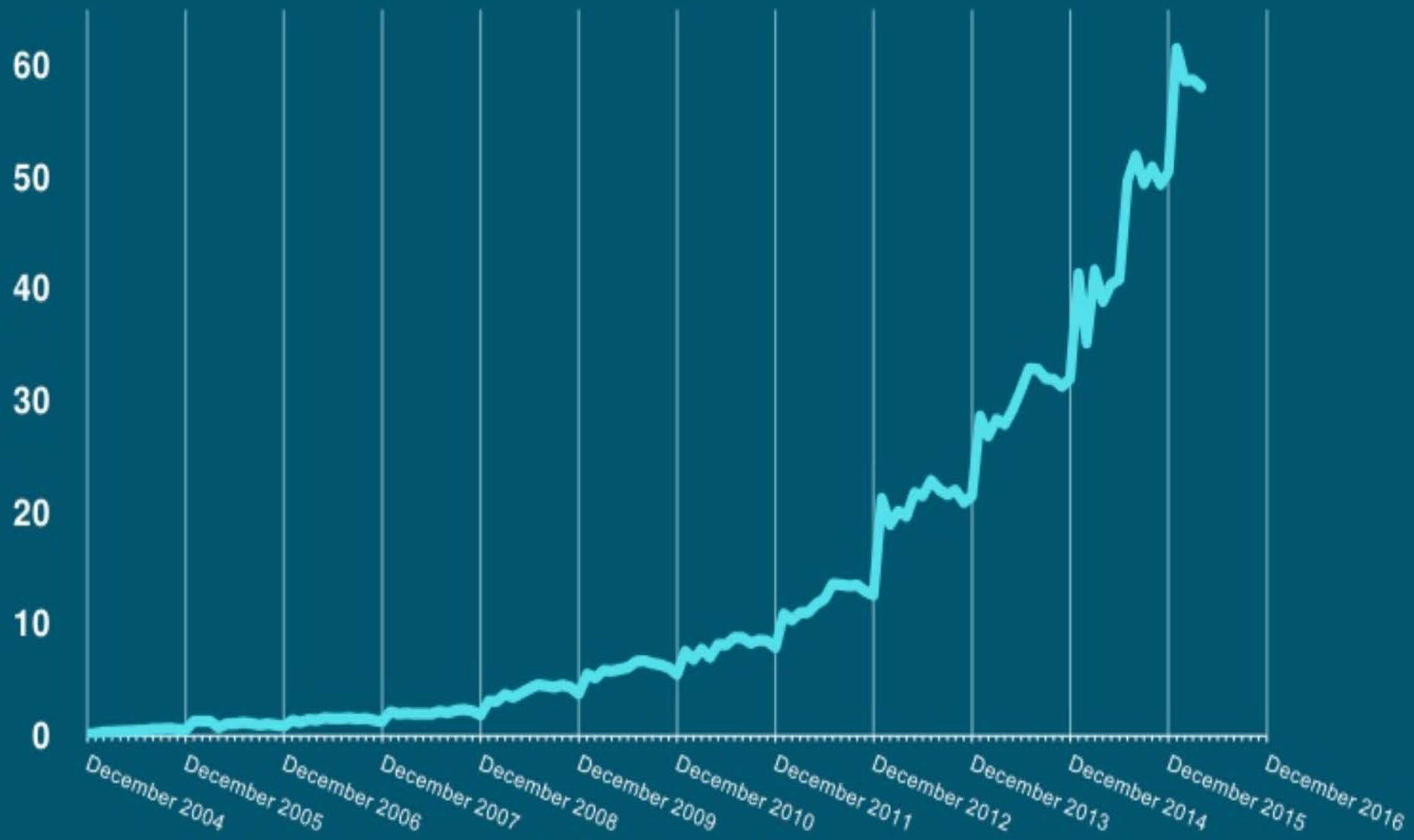
☐ Add nearby airports

☐ Direct flights only

Flexible?
Search 'Everywhere'

Search flights →

Website & Mobile unique monthly visitors
(Millions)



(Some of the)
Product
Machine
Learning
Problems

Price Accuracy

Ensuring that what you see is what you'll get

Search

Finding the best itinerary for your needs

Recommendation

Inspiring you to travel to new places

Ad relevance

Connecting partners with the right travellers

Conversations

Go and try our Facebook bot 😊

Alerting

Keeping you informed, finding the best time to buy

Destinations Industry Session on Monday



Departure times

Outbound
00:00 – 23:59



Return
00:00 – 23:59



Journey duration

2 hours – 24.5 hours



Airlines

Select all | Clear all

oneworld

SkyTeam



18:35
LHR

14h 40
1 stop AMS

10:15⁽⁺¹⁾
LIN



20:40
LIN

23h 40
1 stop CDG

19:20⁽⁺¹⁾
LHR

4 deals from
£280

Select →



21:00
LHR

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LIN



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22h 50
1 stop CDG

18:30⁽⁺¹⁾
LHR

1 deal
£294

Select →



21:00
LHR

12h 15
1 stop AMS

10:15⁽⁺¹⁾
LIN

2 deals from
£298

Select →

Segments

✓ 77% 16:41

← London - Brindisi
5 Sep - 12 Sep

412 results SORT & FILTER

16:55 - 22:40
LHR - BDS, Alitalia 4h 45m
1 stop

19:05 - 10:25⁺¹
BDS - LCY, Alitalia 16h 20m
1 stop

😊 6.5
Cheapest £126
via BudgetAir

18:50 - 10:30⁺¹
LHR - BDS, Alitalia 14h 40m
1 stop

19:05 - 10:25⁺¹
BDS - LCY, Alitalia 16h 20m
1 stop

😊 5.8
Cheapest £126
via BudgetAir

18:50 - 10:30⁺¹
LHR - BDS, Alitalia 14h 40m
1 stop

21:40 - 10:25⁺¹
BDS - LCY, Alitalia 1 stop

78% 16:36

← London - LIN
9 Sep

7 of 144 shown SORT & FILTER

7 direct flights per day
Average duration: 1h 55m [HIDE](#)

British Airways £35
→ 12:00 16:05 18:35 19:25 >

easyJet £85
→ 13:25 19:55 >

Alitalia £105
→ 18:50 >

19:25 - 22:20
STN - LIN, British Airways 1h 55m
Direct

😊 9.7
Cheapest 2nd shortest
via Skyscanner £35
via omegaflightstravel

19:55 - 22:50 1h 55m

Can we do
better?

By recommending
itineraries?

From itineraries to widgets: **The tale of Skyscanner app's dynamic result page**
<https://medium.com/@SkyscannerCodevoyagers/from-itineraries-to-widgets-9b89ca72fda4>

Choice Complexity

Flexibility

Are you sure about your dates, your origin, your destination?

Sensitivity

Will you pay more to stick to plan, or change your plans to pay less?

Availability

What itineraries are currently available, and how will their price change?

Familiarity

Is this a trip that you have made before?

Money saving tip

Depart a day later and save £250 per person.

[Change dates](#)



Telenor HU

14:51

75%

<

Search Flights

Return

One Way

Multi-city

Budapest

Sydney Kingsford S...

Aug 22., Tue

Aug 30., Wed

1 adult, Economy Class

Sort

Filter

Best flights

i

Emirates

16:00 - 22:05⁺¹

1 stop, 22h 5m

Emirates

Emirates

21:10 - 12:45⁺¹

1 stop, 23h 35m

Emirates

440 562 Ft

16:00 - 22:05⁺¹

1 stop, 22h 5m

Emirates +

21:10 - 12:45⁺¹

1 stop, 23h 35m

Qantas + Em

4

239 of 239 results shown sorted by Price

7:25 - 20:10⁺¹

BUD-SYD, British Airways + Cathay Paci...

28h 45m

2 stops

14:10 - 16:25⁺¹

SYD-BUD, Cathay Pacific + British Airways

28h 45m

2 stops

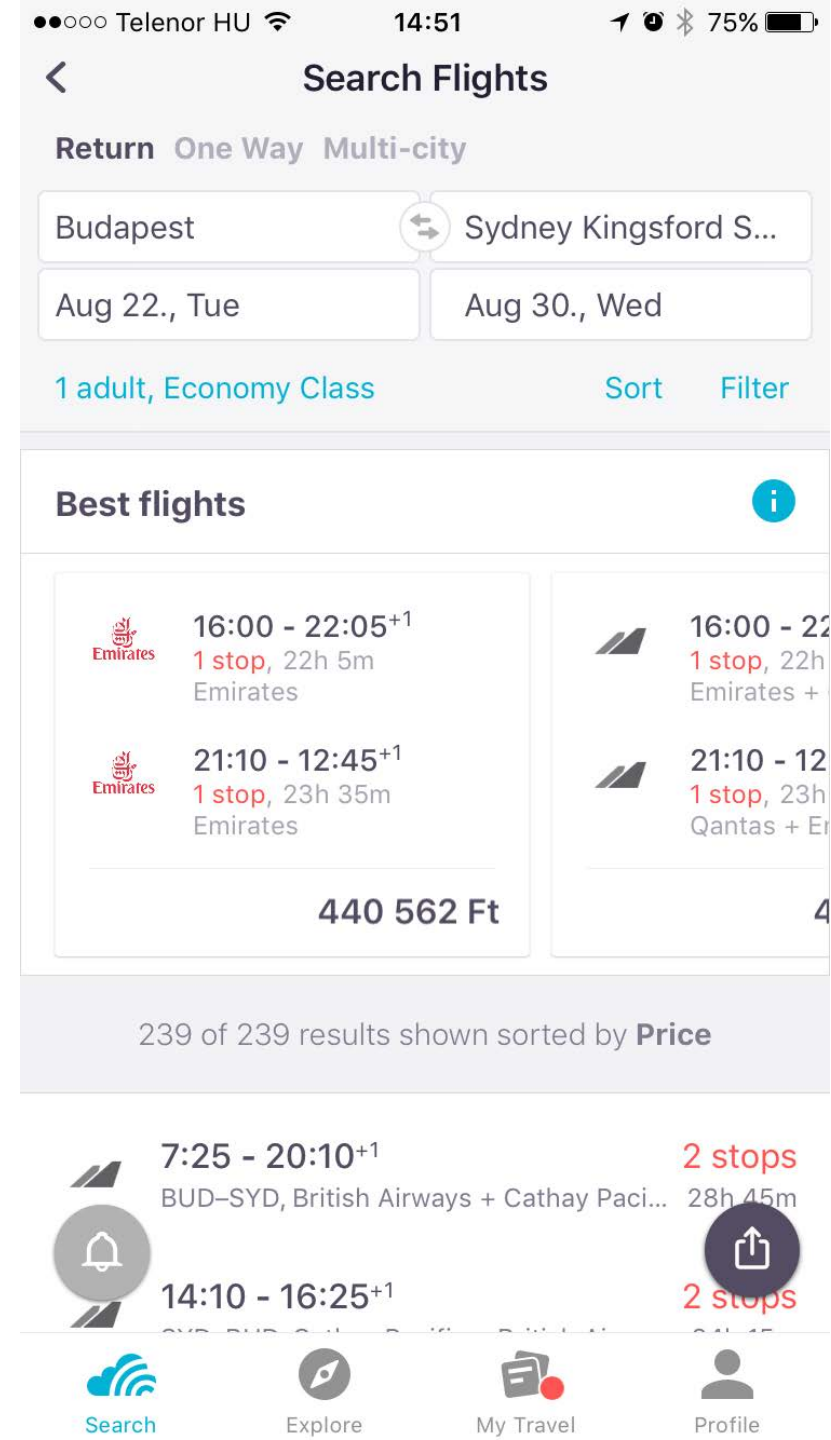
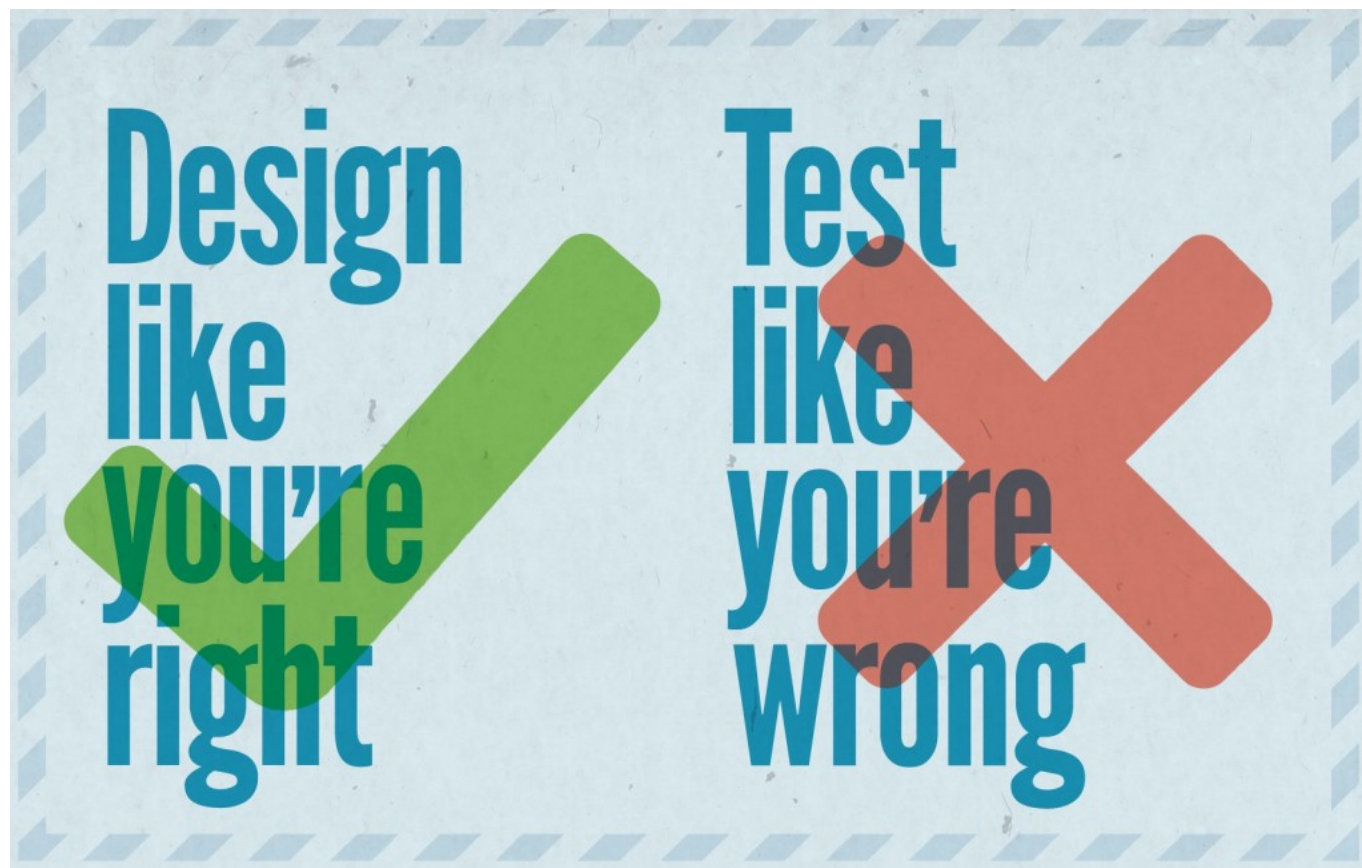
28h 45m

Search

Explore

My Travel

Profile



(4) Challenges Ahead

Workshop on Recommenders in Tourism

Too many to list!

- Personalising without removing control and transparency
- Sparse user history
 - Other signals- photos
 - Other problems- alerting, quality
 - Other approaches- embeddings
- Bridging between international and urban
 - What is a place?
 - Venue, neighbourhood, city, country
- Rethinking Context
 - Events
 - Recurrent trips
 - Mixed contexts (business + leisure, +)

Opportunities & Challenges in Personalised Travel

@neal_lathia, @CodeVoyagers

Workshop on Recommenders in Tourism

