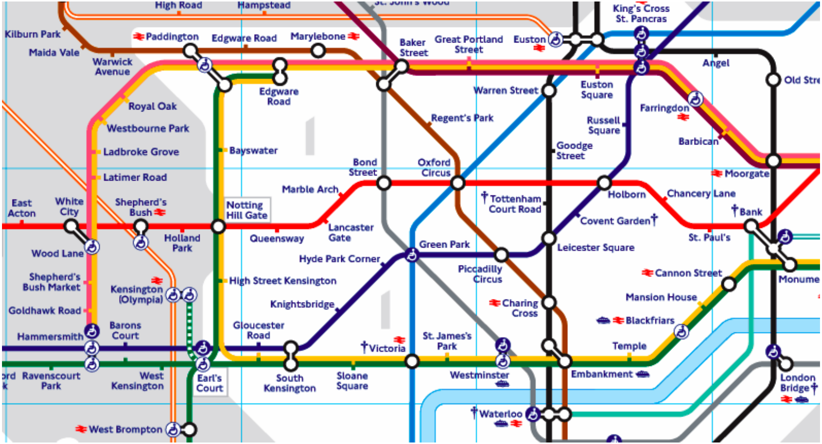
Online Sabotaged Shortest Path

Manfred K. Warmuth   Wouter M. Koolen   **Dmitry Adamskiy**

UNIVERSITY OF CALIFORNIA SANTA CRUZ   Queensland University of Technology   Berkeley UNIVERSITY OF CALIFORNIA   ROYAL HOLLOWAY UNIVERSITY OF LONDON

Online shortest path



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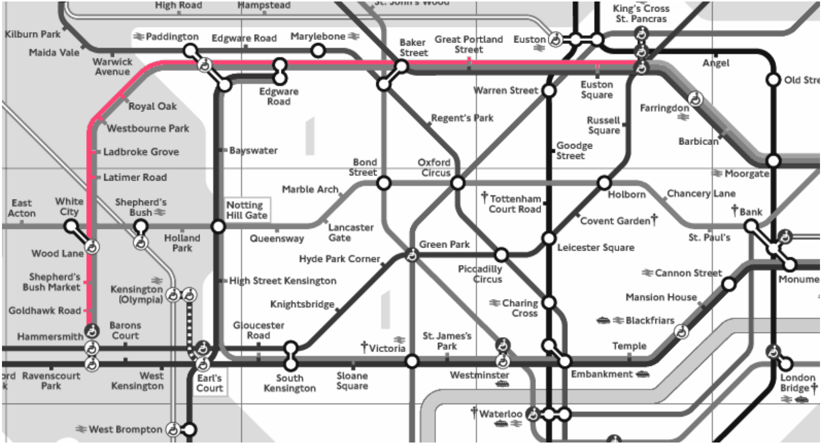

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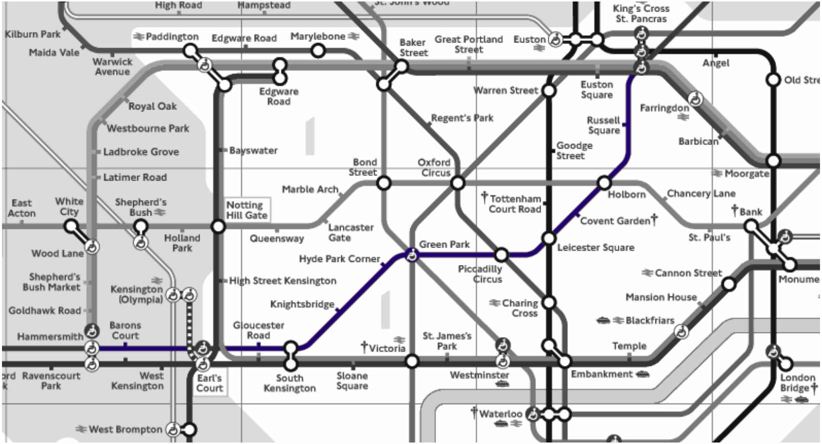

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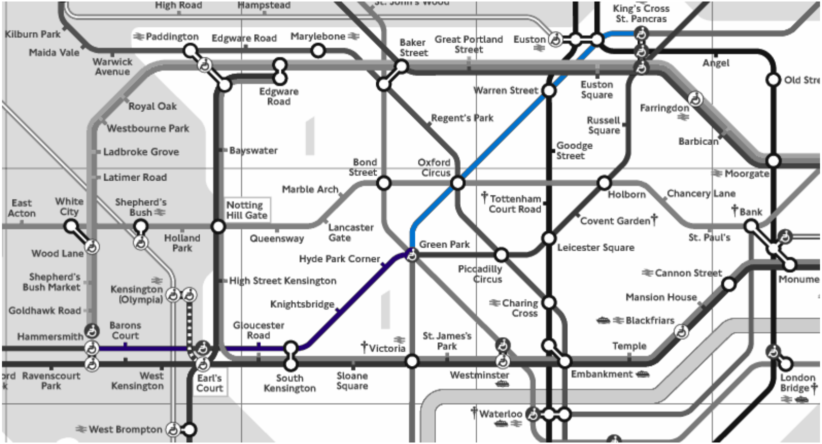

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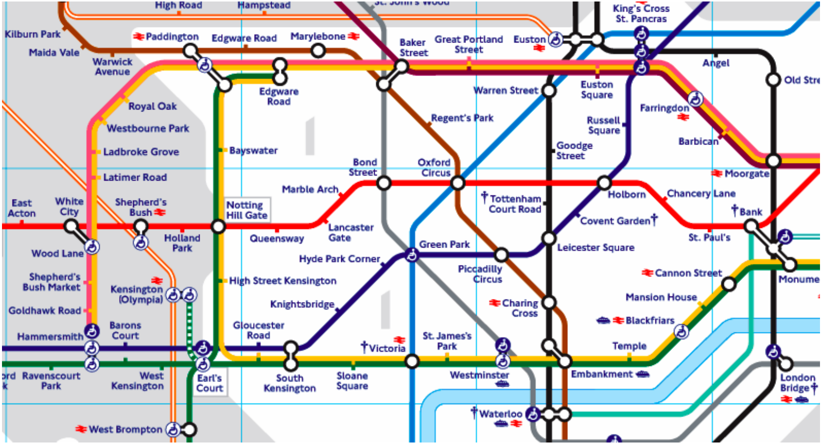
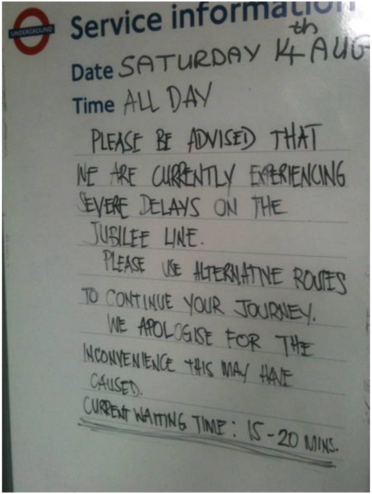


Goal: close to best path in hindsight

Solution: Component Hedge, Mirror Descent, FTPL

Delays, engineering works and strikes!

Adversarial losses. . .



UNDERGROUND

Service information

Date SATURDAY 14th AUG

Time ALL DAY

PLEASE BE ADVISED THAT WE ARE CURRENTLY EXPERIENCING SEVERE DELAYS ON THE JUBILEE LINE.

PLEASE USE ALTERNATIVE ROUTES TO CONTINUE YOUR JOURNEY.

WE APOLOGISE FOR THE INCONVENIENCE THIS MAY HAVE CAUSED.

CURRENT WAITING TIME: 15-20 MINS.

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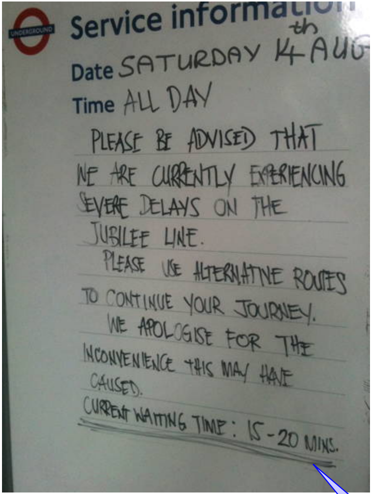

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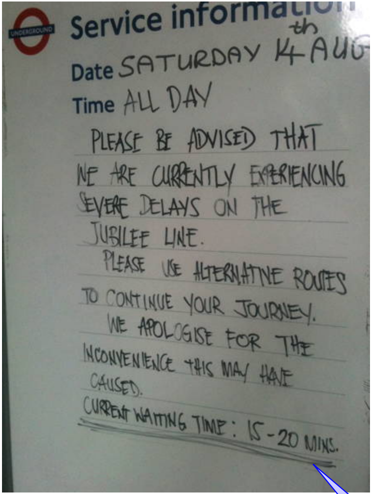

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. . . and some paths are blocked

Service information

Date

Time CLOSED STATIONS

Aldgate East, Angel, Barbican,
Bermondsey, Bethnal Green, Blackfriars,
Borough, Boston Manor, Bromley by bow,
Canada Water, Chalk farm, Clapham
North, Clapham South, Euston Square,
fulham Broadway, Gloucester Road,
Goodge Street, Great Portland Street,
Heathrow T4, Highgate, Hounslow west.
Knightsbridge, Ladbroke Grove, Lambeth
North, Leicester Square, Maida Vale,
Mile End, Mornington Crescent, North
Ealing, Notting Hill Gate, Oval, Piccadilly
Circus, Pimlico, Redbridge, Regents Park,
Sloane Square, Southgate, Southwark,
Stepney Green, Temple, Tufnell Park,
Vauxhall, Warren Street.

“Good service on all other London Undergound lines”

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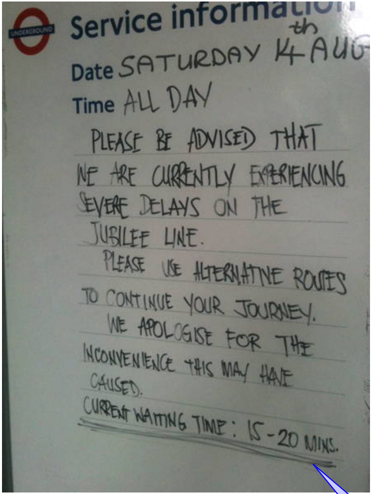

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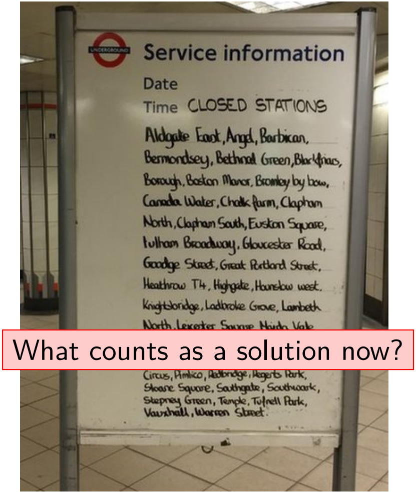

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Circus, Pimlico, Redbridge, Regents Park, Sloane Square, Southgate, Southwark, Stepney Green, Temple, Tufnell Park, Vauxhall, Warren Street.

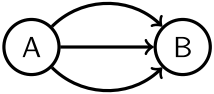
What counts as a solution now?

“Good service on all other London Undergound lines”

Previous work: policy regret

Compete with policy for choosing alternatives to blocked paths...

- In fully adversarial setting it is computationally hard already for experts [Kanade and Steinke, 2014]:



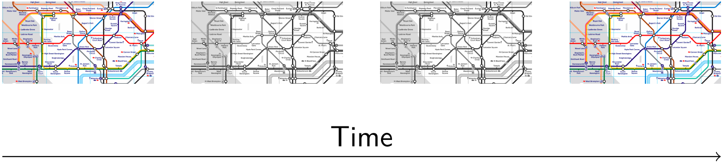
- If sabotages are stochastic and losses are decoupled from them, then efficient algorithms exist [Neu and Valko, 2014]

Proposed notion of regret

We seek a natural notion of regret that avoids the hardness.

Get back to basics and compete with the path only on the rounds when it is awake.

$$\text{Regret}(\text{Path}) = \sum_{\substack{\text{rounds when path}\\ \text{is awake}}} \Big(\text{loss}(\text{Learner}) - \text{loss}(\text{Path})\Big)$$



The Open Problem

Is there an efficient algorithm for our regret?

- Less expressive than policies
- Historically the first notion of sleeping
- Efficient algorithm for expert setting
- Naive, grossly inefficient algorithm gets

$$\text{Regret}(\text{Path}) \leq \text{Diameter}\sqrt{T \log |\text{Paths}|}$$