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# Pace My Race:

## Recommendations for Marathon Running

Jakim Berndsen, Barry Smyth and Aonghus Lawlor

A World Leading SFI Research Centre



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# Introduction

- Marathon running is a **mass participation event**.
- Many Runners collect **data on smartwatches**.
- Marathon running is an **ideal domain for recommender systems**.
  - Runners constantly looking for improvement, and lots of data to generate predictions and recommendations



# Why Recommender Systems?

- Hard to find reliable information
- Data currently just being displayed to user
- Can we use data to **inform training?**
- Leverage data to **improve performance.**
- Help runners run safer?  
Avoid **Hitting The Wall**





# Related Work

## Training

- E-coaching
  - Suggest training sessions to increase performance

## Goal Setting

- Goal Time Prediction
  - Based on training and previous performance [Riegel 1981]
  - PB prediction [Smyth & Cunningham @ RecSys2017]

## Race Strategy

- Race Pacing Plan
  - Dividing efforts to maximise performance [Smyth @ IJCAI 2018]

# Aims

- All work conducted to date focussing on recommendations and predictions prior to race start.
- Only in race application a crudely predicted finish time for spectators.
- **What happens if things do not go to plan?**
- Aim to:
  - **(a) Improve in-race finish time prediction.**
    - Allow runners to see if they are on target.
  - **(b) Make a recommendation of a personalised pacing strategy during the race to guide the runner to the finish line.**



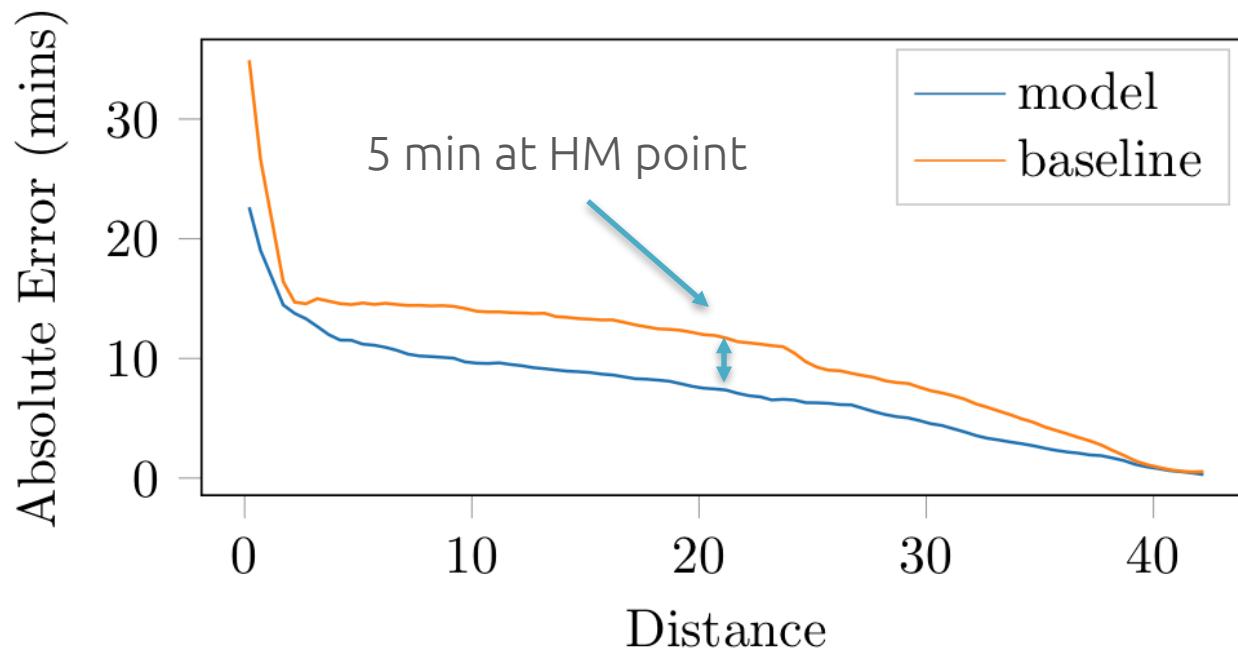
## Data

- Marathon data for ~13000 runners, 7931 after cleaning.
- **Pace** (min/km), **Heart Rate** (BPM) and **Cadence** (steps/min) for every runner.
- Collect summary data over Short (1km), Medium (5km) and Long (race to point) windows for each feature.
  - Correspond to efforts and interval lengths runners use to describe performance.



The Strava logo is displayed in its signature orange color. The word "STRAVA" is written in a bold, sans-serif font. The letters are thick and have a slight slant to the right. The letter "T" has a unique design where the top horizontal bar is shorter than the bottom one, creating a stylized 'W' shape.

# In-Race Finish-Time Prediction (using XGBoost)

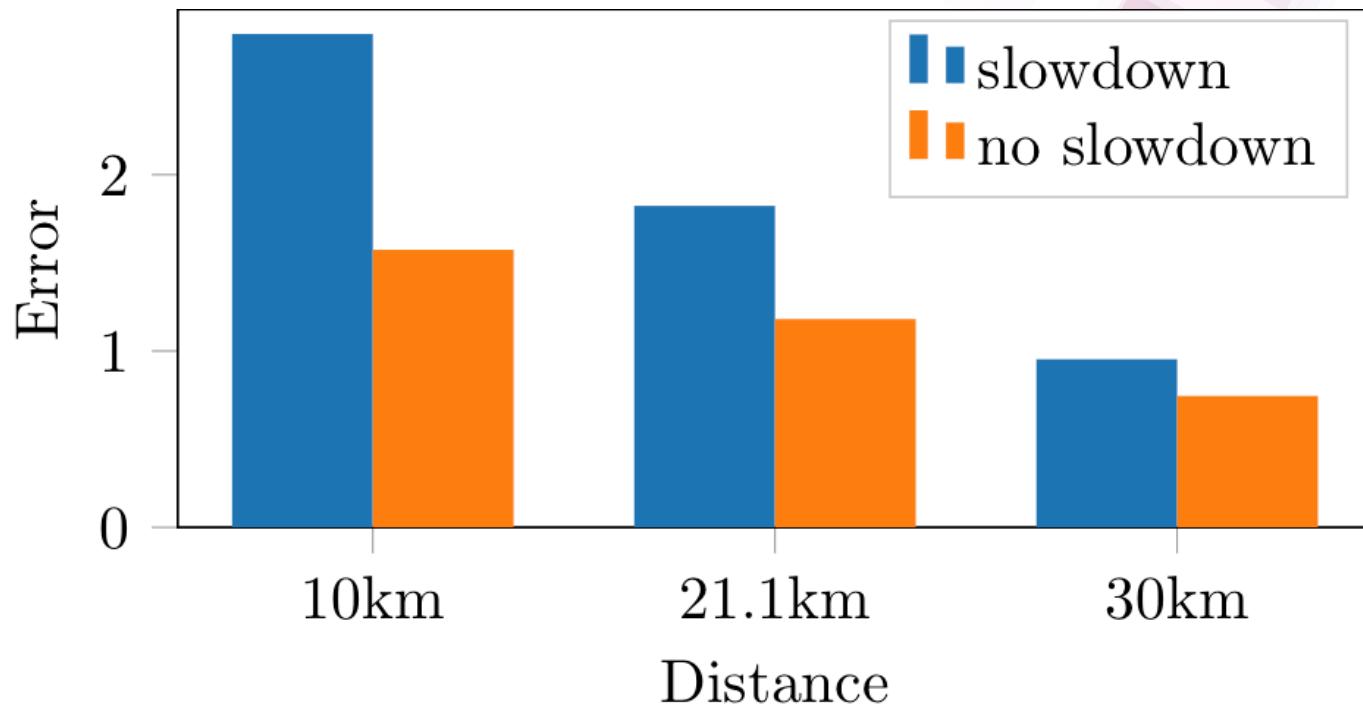


Substantial improvements in the **early to middle stages** of the marathon.

# Replanning due to Race Slowdown

- **Aim:** Identify runners likely to have a **large slowdown**, and **replan their race** accordingly.
- Use runners that adjust pace as **exemplars**.
- If runner at risk of slowing down we:
  - Find **similar** runners using race data to that point.
  - Calculate the **average pacing adjustments** the similar runners undertook
  - **Adapt** these adjustments to match the **new expected finish time** of the runner
  - Present these as a recommendation to the user

# Evaluating Recommendations

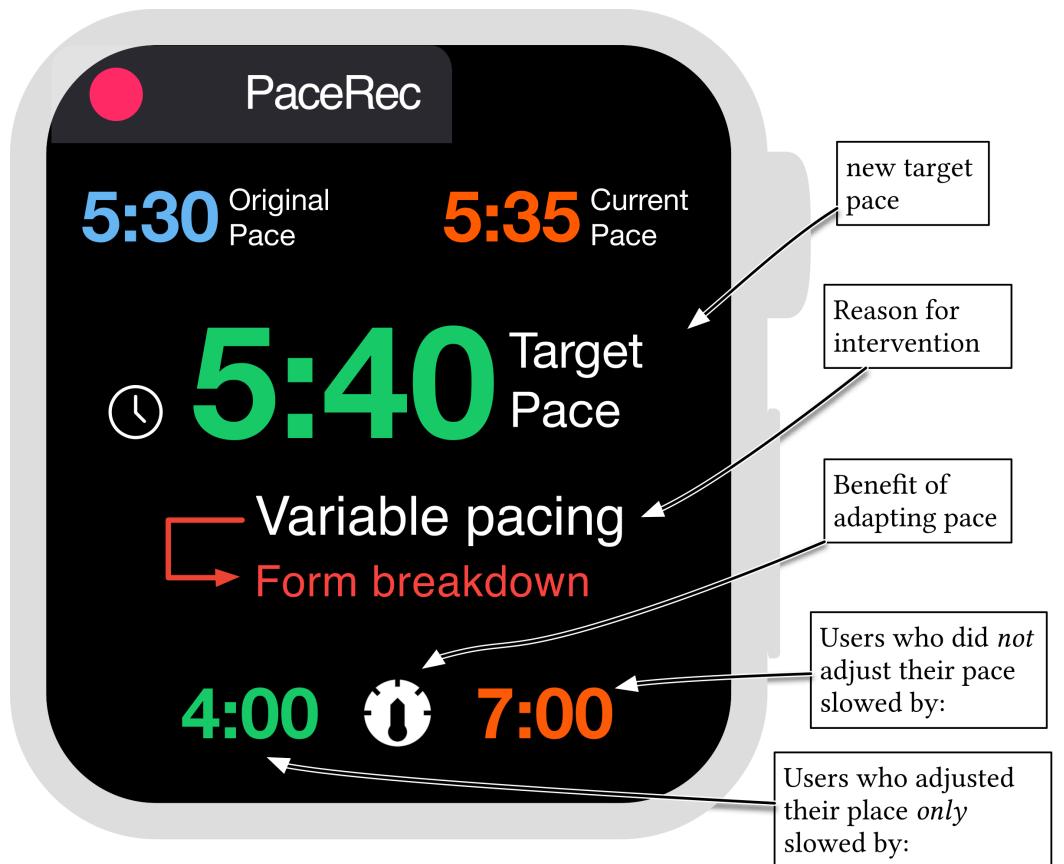


Recommended plans correspond closely to those followed by runners that adjust pace.

# Explainability

- Recommendations must be:
  - **Well Timed**
    - Key points of the marathon (aid stations, landmarks, distance milestones)
  - **Simply Explained**
    - Features used relate to **Race Features** runners use to describe their race
    - Decision made fed back to user (e.g unsustainable heartrate)
  - **Demonstrate Benefit**
    - Show expected performance if those who adapted pace compared to those who did not
- Hybrid explanations at well timed intervals should lead to **trust** and **adherence** from runners

# Mockup



## Conclusions and Future Work

- Built a model to predict finish time in race
- Generated recommendations to guide runners safely to the end of the race
- Provided meaningful explanations
- Look to incorporate previous performance data and training
  - Improve both predictions and user similarity
- User Study – Ongoing in Research Group



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[jakim.berndsen@insight-centre.org](mailto:jakim.berndsen@insight-centre.org)

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