

# RECON | vimes

An evidence-synthesis approach for detecting outbreak clusters

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Thibaut Jombart

4-6th September 2018

**London School of Hygiene and Tropical Medicine**

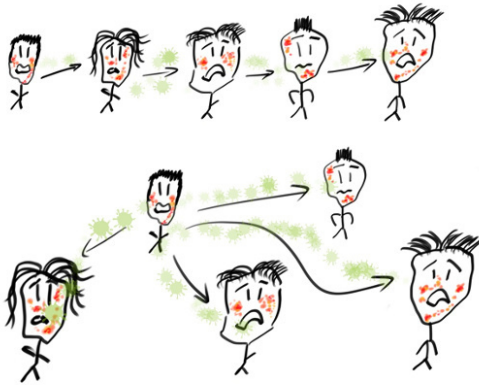
Imperial College London

Context...

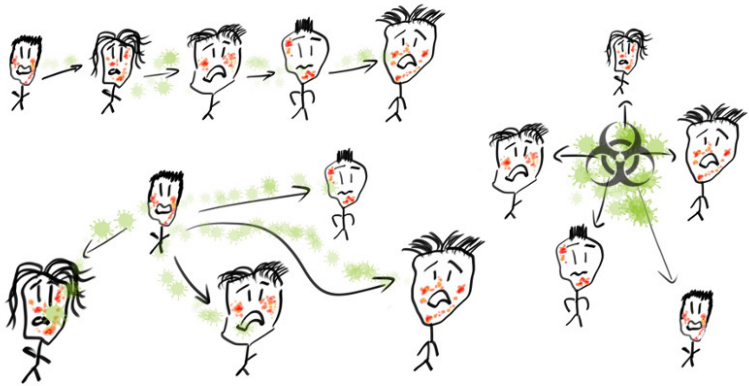
# Sustained transmission vs repeated introductions



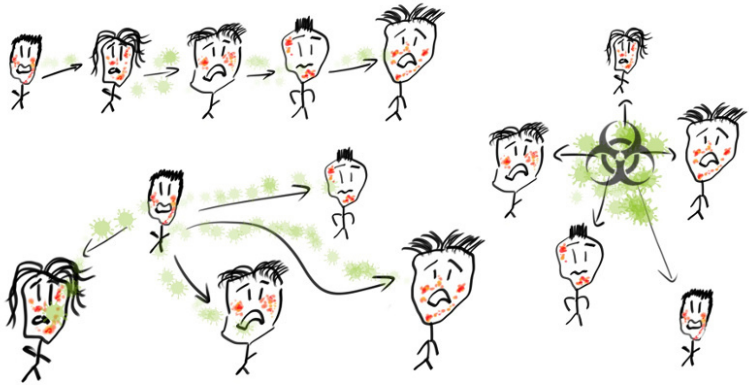
# Sustained transmission vs repeated introductions



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Different **transmission patterns** call for **different interventions**

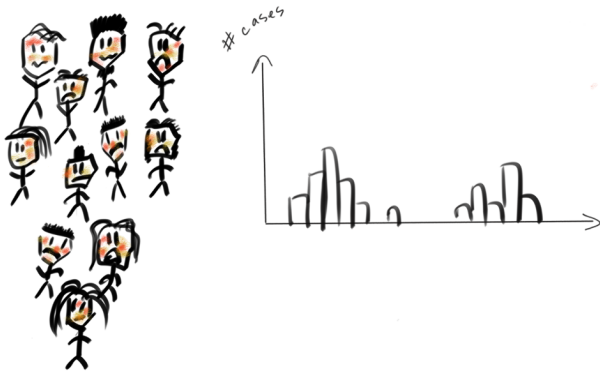
Can we use data to identify these patterns?

# One outbreak... how many introductions?

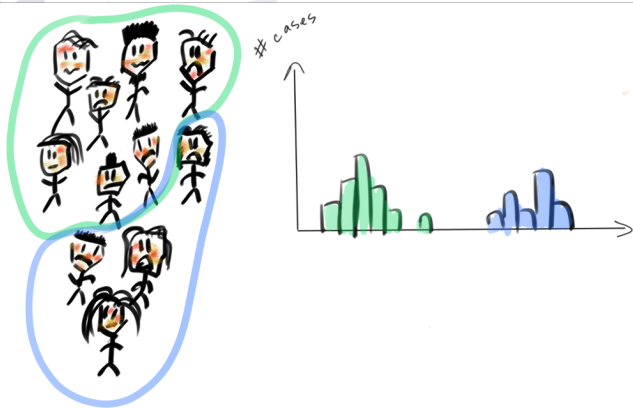




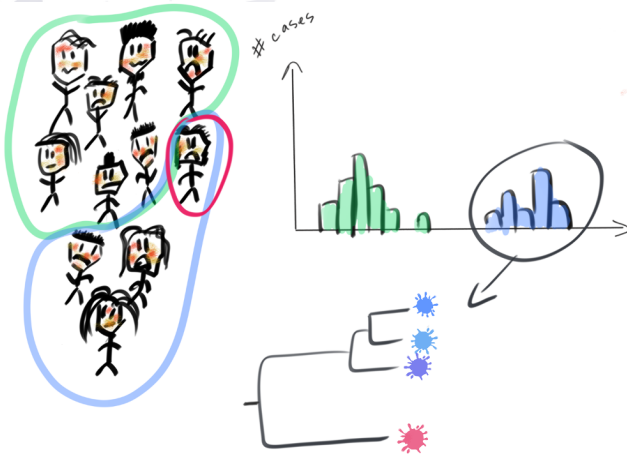
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Combined data sources can detect outbreak clusters

# VIMES: Visualisation and Monitoring of EpidemicS<sup>1</sup>



Aims: develop a new method which...



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<sup>1</sup> well, really, I made that up because I was reading 'Snuff' by Terry Pratchett at the time; incidentally, Pratchett was a huge fan of using long footnotes in his novels, which are often quite entertaining to read; well, this does not apply here: if you are still reading this, you probably missed what I just said

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Aims: develop a new method which...

- **detects outbreak clusters**: cases stemming from same introduction (same transmission tree)
- **integrates different data**: temporal, spatial, genetic, etc.
- **works fast, scales well**: so that it can be used for real-time outbreak detection

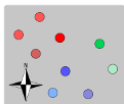


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# A graph-based evidence synthesis approach

A

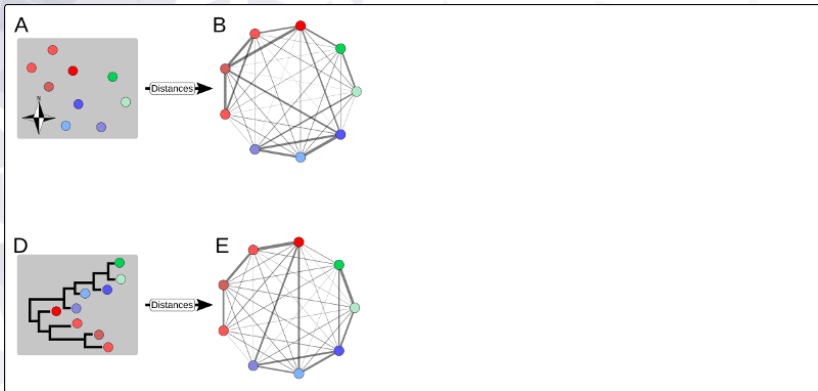


D

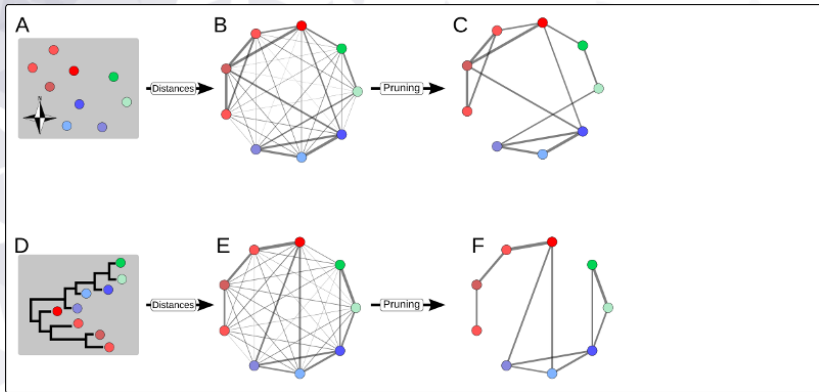




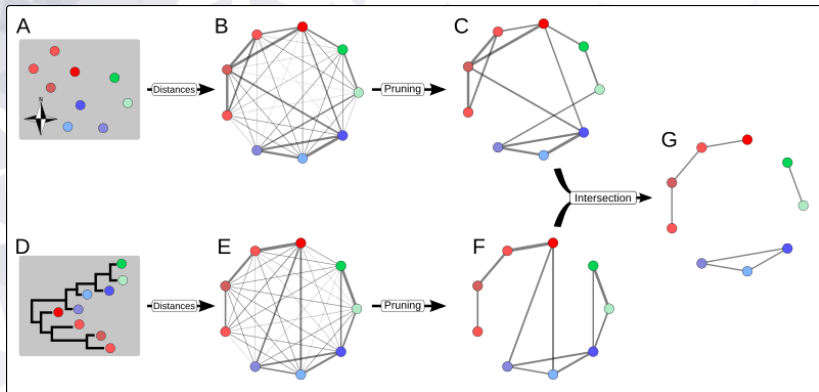
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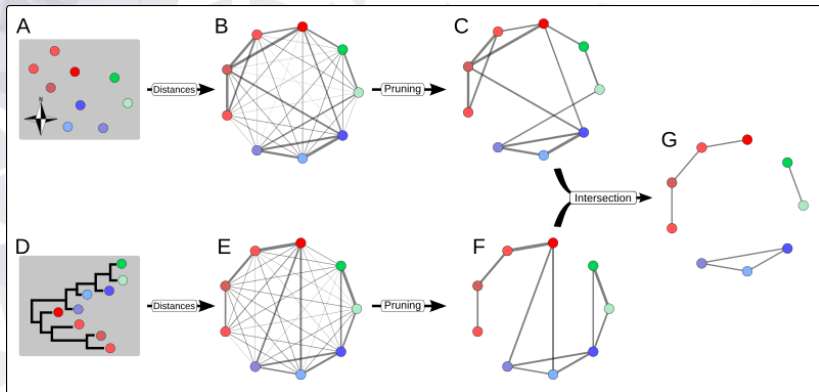
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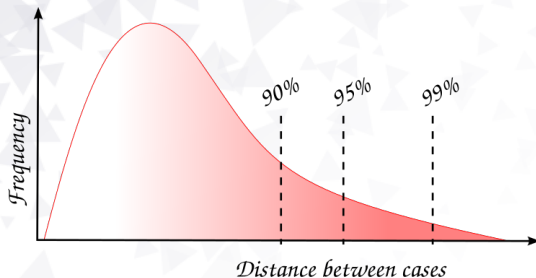


Can be extended to **any number of data sources**.

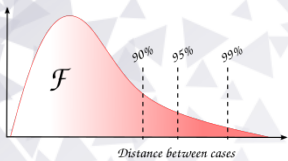
But it seems too simple...

# Pruning graphs: where to cut?

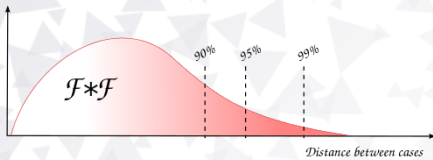
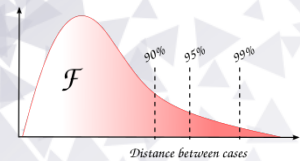
Assuming a known expected distribution between pairs of cases (e.g. serial interval, spatial kernel, molecular clock), different quantiles can be used:



# Pruning graphs: where to cut?

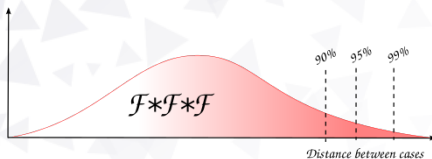
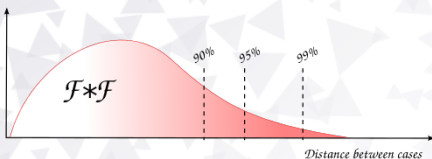
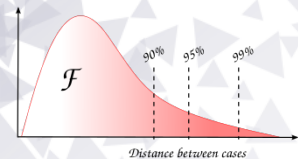


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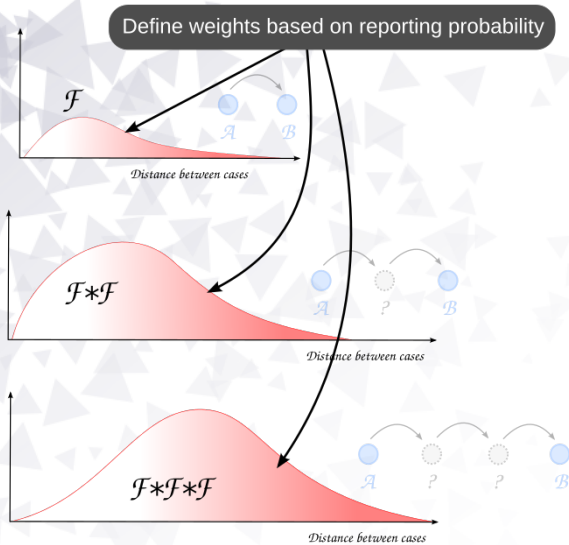




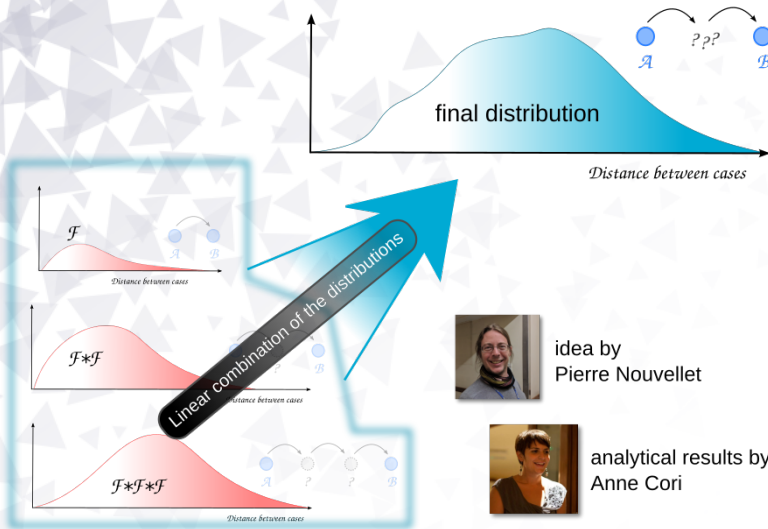
# Pruning graphs: where to cut?



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idea by  
Pierre Nouvellet



analytical results by  
Anne Cori

**What does it look like in practice?**

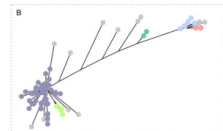
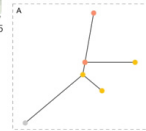
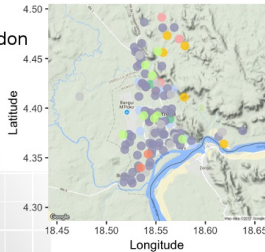
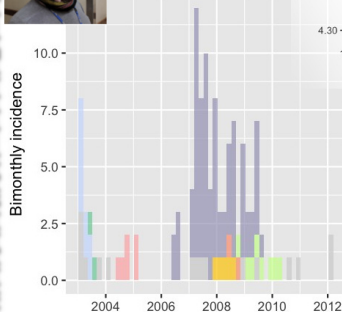
# Application: dog rabies epidemics, Central African Republic



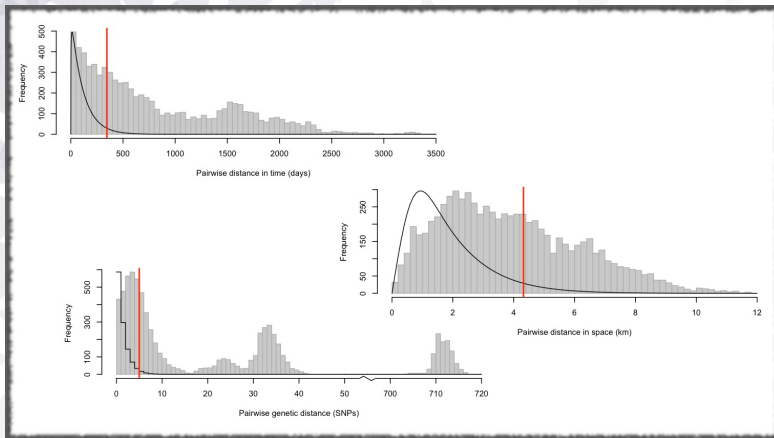
Anne Cori  
Imperial College London



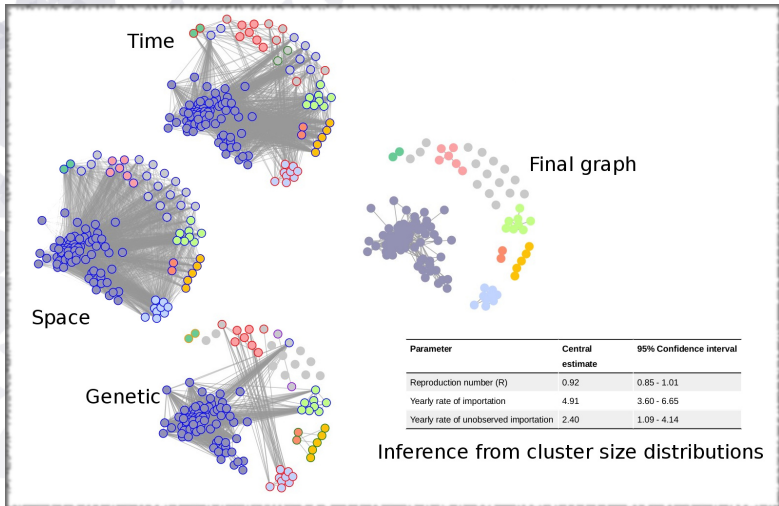
Pierre Nouvellet  
University of Sussex



# Distributions of distances between cases



# Results



What's the take home message?



# Summary

## vimes:

- can **integrate** different data sources to detect outbreak clusters
- need arbitrary **threshold**: unsatisfying, but sensitivity study easy
- is **fast**, and can integrate data pipelines easily

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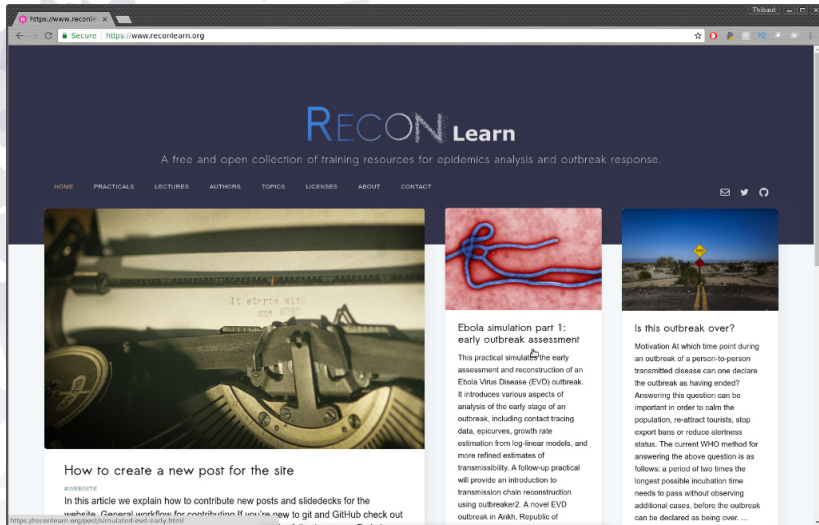
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## On our TODO list:

- integration in **genomic surveillance** systems (PHE)
- improve scalability (sparse matrices)
- objective criteria for **automated threshold selection**

Tutorials and lectures on this coming soon  
on...

# RECON learn 2.0 (freshly online!)



The screenshot shows the RECON Learn website in a web browser. The browser's address bar displays "https://www.reconlearn.org". The website has a dark blue header with the "RECON Learn" logo in white and blue. Below the logo, a tagline reads "A free and open collection of training resources for epidemics analysis and outbreak response." A navigation menu includes links for HOME, PRACTICALS, LECTURES, AUTHORS, TOPICS, LICENSES, ABOUT, and CONTACT. Social media icons for email, Twitter, and GitHub are also present.

The main content area features three columns:

- Left Column:** A large image of a typewriter with the text "It starts with ONE WORD" on the paper. Below the image is the heading "How to create a new post for the site" and a subheading "#WEBSITE". The text explains how to contribute new posts and slide decks, mentioning a general workflow for contributors and a specific link for new users: <https://reconlearn.org/post/simulated-ebv-early.html>.
- Middle Column:** A red background with a blue line graph. The heading is "Ebola simulation part 1: early outbreak assessment". The text describes a practical simulation for early assessment and reconstruction of an Ebola Virus Disease (EVD) outbreak, covering aspects like contact tracing, data analysis, and model estimation. It mentions a follow-up practical for transmission chain reconstruction using outbreaker2 and a novel EVD outbreak in Ankh, Republic of...
- Right Column:** A landscape image of a road with a yellow diamond-shaped sign. The heading is "Is this outbreak over?". The text discusses the motivation for asking this question during an outbreak, the importance of declaring an outbreak as having ended, and the current WHO method for answering this question, which involves a period of two times the longest possible incubation time.

*www.reconlearn.org*

# Thanks

- **Conference organisers**
- **Colleagues:** Anne Cori, Pierre Nouvellet, Tini Garske, Hervé Bourhy, Emmanuel Nakouné
- **funding:** HPRU-NIHR, MRC

*vimes*

*www.repidemicsconsortium.org/vimes*

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