Probability and Statistics

with Dr Min Xu

Talking *points*

Knowledge

1. What are the components of a network?
2. What is the Bayes rule?

Comprehension

3. What are the similarities and differences between a social network and a disease transmission network?
4. Why would an epidemiologist want to determine the root node of each community in a disease transmission network?
5. What is the difference between probability and statistics?

Application

6. If you were a counter-terrorism investigator, how could you use Min's model to help you find the founders of a terrorist organisation?
7. If you were a geneticist that has used Min's model to identify the gene linked to a genetic disorder, how could this information be useful to you?
8. In what other situations could you apply Min's model? What examples of networks could it help you learn about?

Analysis

9. Why is it impossible to perfectly reconstruct the actual history of a network? What does Min do instead?
10. How does the Bayes rule enable Min to uncover the history of a network?
11. How could an understanding of probability and statistics help you in your day-to-day life?

Activity

What does your social network look like?

A network can be represented graphically by dots that represent nodes, connected by lines that represent edges. Draw a dot in the centre of a large piece of paper, and label it with your name – this represents you as the root node of your social network. Surround your dot with labelled dots representing people you know. Connect each node to your root node with a line representing your relationship with that person. You could use a thicker line to represent a stronger relationship.

Think about people you have known at different stages in your life, including immediate and extended family members, friends and teachers from different stages of your school journey, people involved in any extra-curricular activities you participate in, etc. Once you have a selection of people who are connected to you, consider how they are connected to each other. Add more edges to show the relationships that exist between your family members, friends and acquaintances. Can you see any communities beginning to form? Are there any important nodes that connect to lots of other nodes?

More *resources*

- Learn more about Min's research: www.sites.google.com/view/minxu/home
- There are many popular science books that will teach you more about probability and statistics. Some good examples include *The Art of Statistics* by David Spiegelhalter, *The Improbability Principle* by David Hand, and *Thinking in Systems* by Donella H. Meadows.