Population Models based on Evolutionary Game Theory

Frank Thuijsman

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MAPRA Workshop 2, July 1 2014, Parma
Area of Expertise

- **Mathematics** of Operations Research
- Stochastic Game Theory (Markov Games)
- Evolutionary Game Theory and Population Dynamics
- Models based on Darwinian fitness maximization
  - Replicator models with *fitness* changing in time
    \[ \dot{p}_k = p_k (e_k A p^T - p A p^T) \]
  - Replicator models with fitness based on many interactions
  - Replicator models with local interactions in grid space
  - Replicator models with local interactions, continuous space
  - Transmission models with local interactions in networks
  - Agent based models (used in study on sex choice in wasps)
  - Theoretical biology (foraging behaviour, tree sex systems)
Global vs. Local Interactions in *Continuous* Space

\[
\begin{pmatrix}
2 & 0 & 1 \\
2.5 & 1 & 0 \\
0 & 2.5 & 1.5
\end{pmatrix}
\]

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Simulation Study on Spread in Networks

Initially 20% $P$, type 1, white

\[
\begin{array}{ccc}
  P & R \\
  6,6 & 0,3 \\
  3,0 & 4,4 \\
\end{array}
\]
Simulation Study on Spread in Networks

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Regression Analysis and Classification Tree Analysis on millions of networks

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Summary

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- Now looking for real life data for tuning.
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Most freedom in continuous space, flexible population size.

Continuous space is computationally more costly than grid.
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Experiments on introduction, establishment and spread of disease have not been done
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Maastricht Local Interactions Team

- Abhimanyu Khan (SBE)
- Ronald Peeters (DKE)
- Katharina Schüller (DKE)
- Mandy Tak (DKE)
- Philippe Uyttendaele (DKE)
- Li You (DKE)

Thank you for your attention!
Any comment is welcome!
Papers are available!

Slideshows were highly reduced for email distribution!