Game-changers:
Detecting shifts in the flow of campaign contributions

Matthew Blackwell
University of Rochester

October 6th, 2012
RocData Forum
<table>
<thead>
<tr>
<th>A.</th>
<th>Full Name (Last, First, Middle Initial)</th>
<th>Sharon Anderson (Mailing Address 1668 finwick dr)</th>
</tr>
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<tr>
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<td>City</td>
<td>pflaftown</td>
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<td>Election Cycle-to-Date</td>
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<th>B.</th>
<th>Full Name (Last, First, Middle Initial)</th>
<th>Riaz Hussain (Mailing Address 540 N Webster Ave)</th>
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<tr>
<td></td>
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| C. | Full Name (Last, First, Middle Initial) | Dave Baird (Mailing Address 1376 Lincoln St) |

Transaction IDs:
- A: C19176830
- B: C20196560
- C: C20090710

Date of Receipts:
- A: 08/12/2012
- B: 08/30/2012
- C: 08/30/2012
A measurement question

When do campaigns take off or fall flat?
A measurement question

When do campaigns take off or fall flat?

When do campaign contributions take off or fall flat?
Changepoint models detect changepoints
The challenges

Modeling daily contribution counts
The challenges

Modeling daily contribution counts

Choosing the number of changepoints
Overdispersion in campaign contributions
The model

\[ y_t \sim \text{Poisson}(\eta_t \lambda_t) \quad \text{(data)} \]
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\[ s_t = k \quad \text{(regime)} \]
The model

\[ y_t \sim \text{Poisson}(\eta_t \lambda_t) \]  \hspace{2cm} \text{(data)}

\[ s_t = k \]  \hspace{2cm} \text{(regime)}

\[ \lambda_t = \exp(X_t \beta_k) \]
The model

\[ y_t \sim \text{Poisson}(\eta_t \lambda_t) \quad \text{(data)} \]

\[ s_t = k \quad \text{(regime)} \]

\[ \lambda_t = \exp(X_t \beta_k) \]

\[ \eta_t \sim \text{Gamma}(\rho_k, \rho_k) \]
The model

\[ y_t \sim \text{Poisson}(\eta_t \lambda_t) \quad \text{(data)} \]

\[ s_t = k \quad \text{(regime)} \]

\[ \lambda_t = \exp(X_t \beta_k) \]

\[ \eta_t \sim \text{Gamma}(\rho_k', \rho_k) \]

Use a Bayesian nonparametric prior to estimate the number of regimes.
The rise and fall of Herman Cain

Probability of Changepoint

Jan 11 Apr 11 Jul 11 Oct 11 Jan 12

0.0 0.2 0.4 0.6 0.8
The rise and fall of Herman Cain
The rise and fall of Herman Cain

Probability of Changepoint

Number of Contributions

Jan 11  Apr 11  Jul 11  Oct 11  Jan 12

Jan 11  Apr 11  Jul 11  Oct 11  Jan 12

0.0  0.2  0.4  0.6  0.8

0  100  200  300  400  500
The rise and fall of Herman Cain

Probability of Changepoint

Jan 11  Apr 11  Jul 11  Oct 11  Jan 12

0.0  0.2  0.4  0.6  0.8

Number of Contributions

Jan 11  Apr 11  Jul 11  Oct 11  Jan 12

0  100  200  300  400  500
The rise and fall of Herman Cain

Probability of Changepoint

Jan 11 Apr 11 Jul 11 Oct 11 Jan 12

Number of Contributions

Fox News Debate

Jan 11 Apr 11 Jul 11 Oct 11 Jan 12
The rise and fall of Herman Cain

Probability of Changepoint

Number of Contributions

Fox News Debate
Announces candidacy
The rise and fall of Herman Cain

Probability of Changepoint

Jan 11, Apr 11, Jul 11, Oct 11, Jan 12

Number of Contributions

Fox News Debate, Announces candidacy, Wins FL straw poll
The rise and fall of Herman Cain

Probability of Changepoint

Jan 11  Apr 11  Jul 11  Oct 11  Jan 12

Number of Contributions

Jan 11  Apr 11  Jul 11  Oct 11  Jan 12

Fox News Debate
Announces candidacy
Wins FL straw poll
Misconduct allegations
The rise and fall of Herman Cain

Probability of Changepoint

Number of Contributions

Fox News Debate
Announces candidacy
Wins FL straw poll
Misconduct allegations
Suspends candidacy
The path forward.
The path forward.

1. Run on all (digitized) Congressional races to find more systematic variation.
The path forward.

1. Run on all (digitized) Congressional races to find more systematic variation.

2. Collect fundraising event data and compare with change-points.
The path forward.

1. Run on all (digitized) Congressional races to find more systematic variation.

2. Collect fundraising event data and compare with change-points.

3. Generalize the Bayesian nonparametric approach beyond count data.