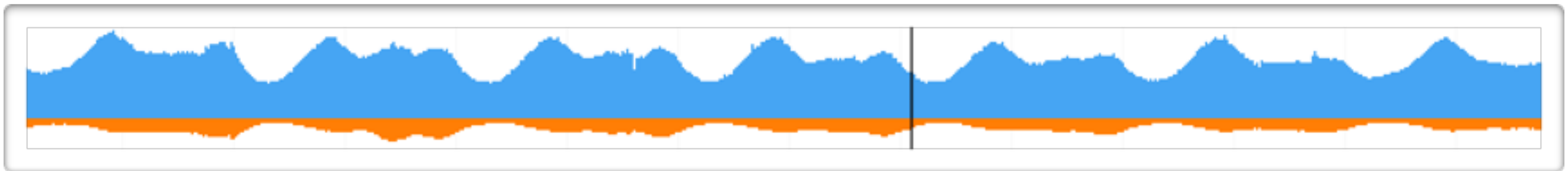
Matisse: A Visual Analytics System for Exploring Emotion Trends in Social Media Text Streams



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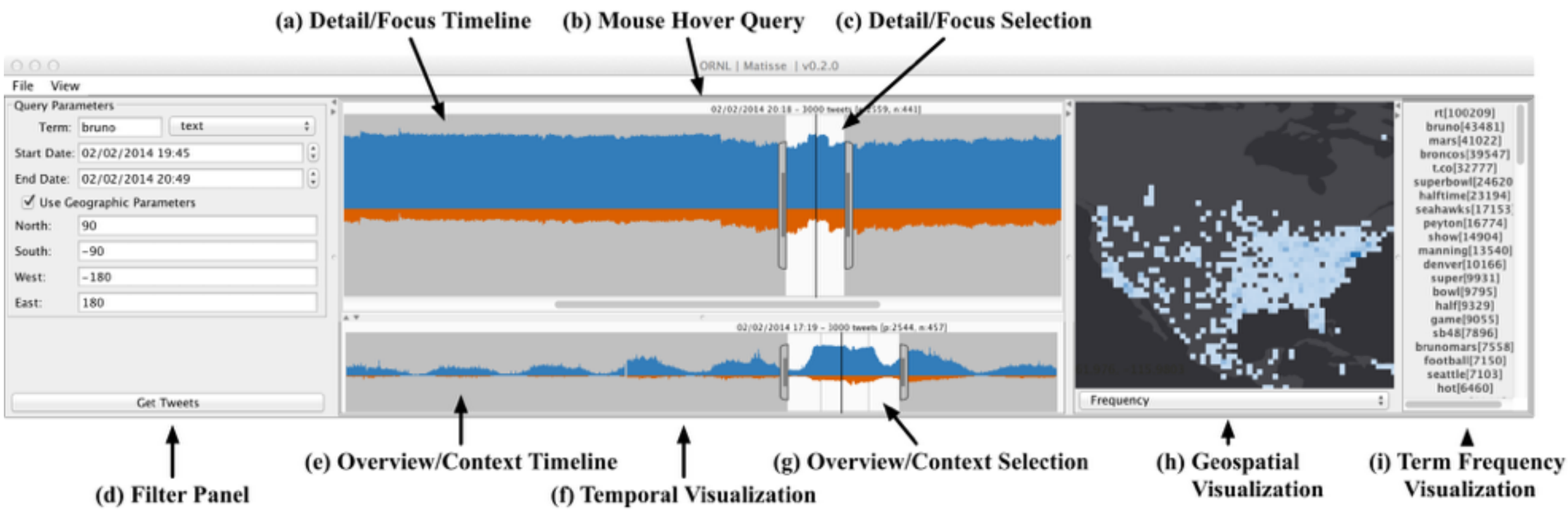
Motivation

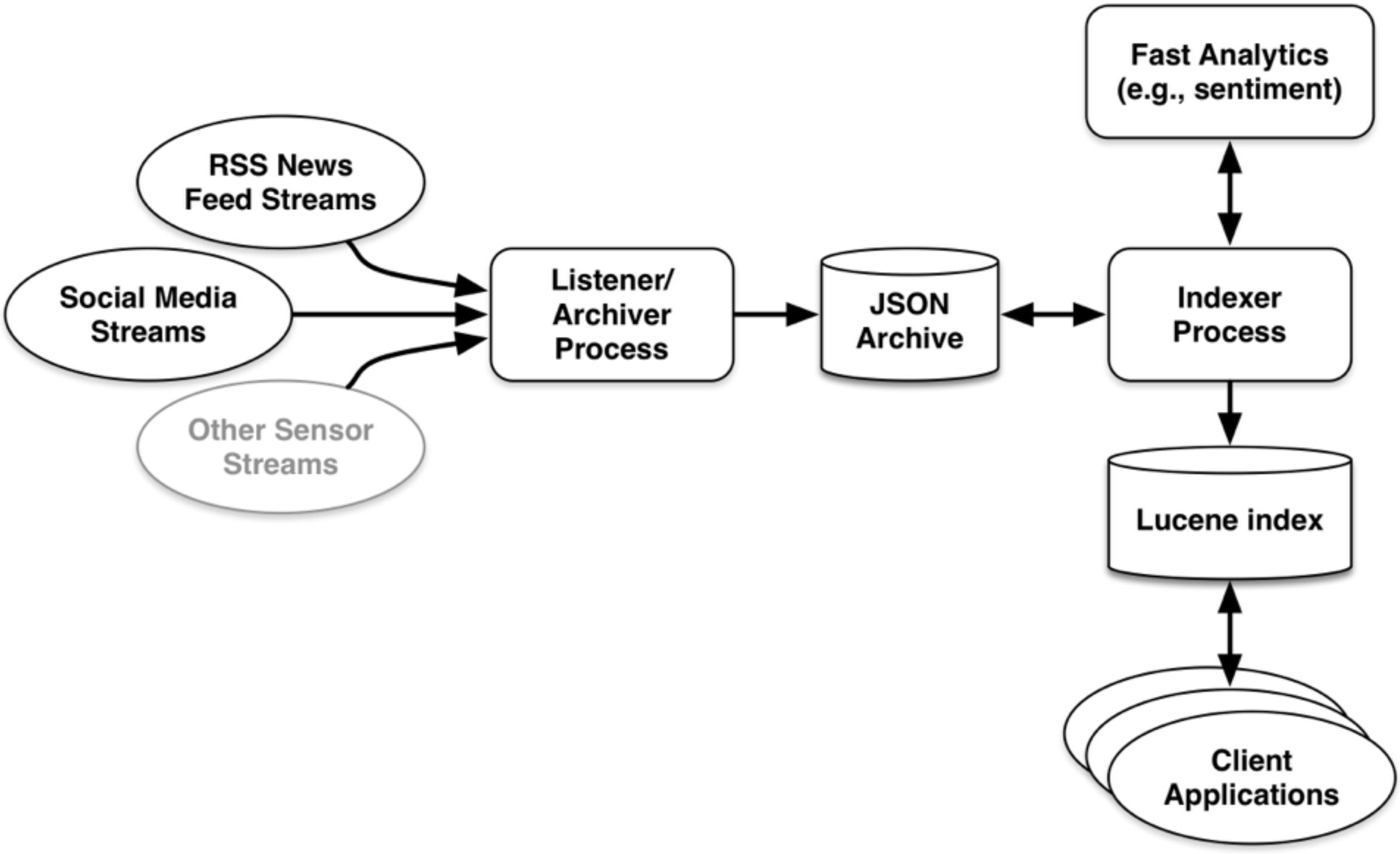
- Social media text streams represent a tremendous resource for understanding global events in real-time.
- But these streams are a challenge to analyze due to large and rapidly changing semi-structured textual information.
  - Too large for a pure visualization approach
  - Too exploratory for a pure analytics approach
- Automated analytics are needed to guide users to key trends and interactive techniques to drill-down to more detailed views.
  - Ideal scenario for a visual analytics approach

Matisse: Exploratory Analysis of Text Streams



Design Goal: Facilitate multi-faceted, exploratory analysis of social media text streams from overviews to detailed investigation

Stream Data Management



Positive / Negative Sentiment Analytics

- Estimate positive / negative sentiment based on textual content
- Initial processing step modifies raw text to accommodate some nuances of Twitter content
- Porter's English stemmer applied and custom stop words are removed
- Train classifier (naive Bayes and Java Maximum Entropy) using pre-coded tweets from Go et al. [4] to create a feature vector.
- Comparable classification accuracy to Go et al. [4] results (80% - 90%)

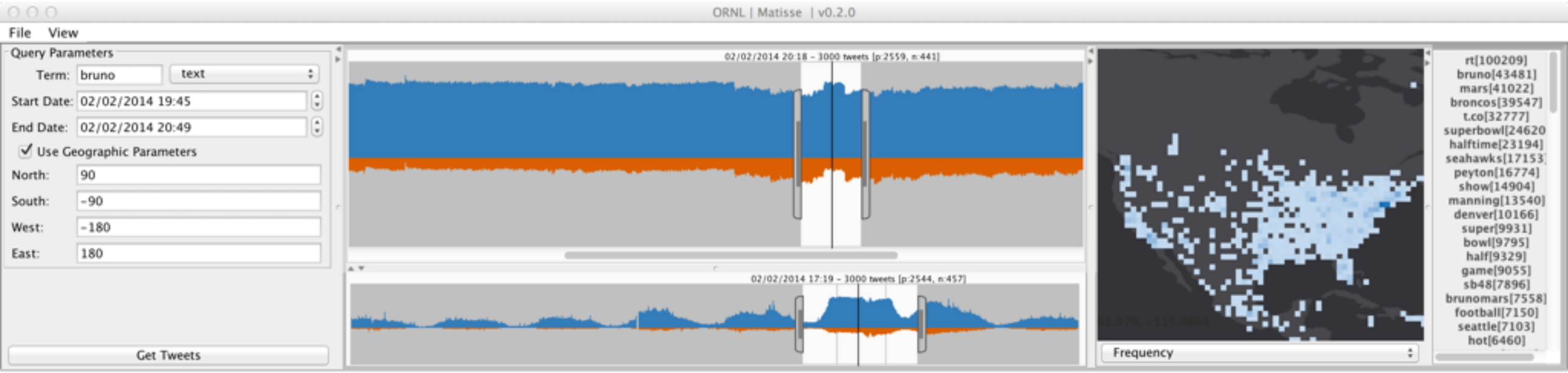
Emotion Classification using Machine Learning

- Estimate textual content's emotion using a ML approach that avoids manual labeling of training data
- Leverages statistical and emotional text analytics trained on pure examples of various emotion classes
- Leverages ANEW [2] model
  - Valence - positivity/negativity
  - Arousal - excitability
  - Dominance - assertion level of the author

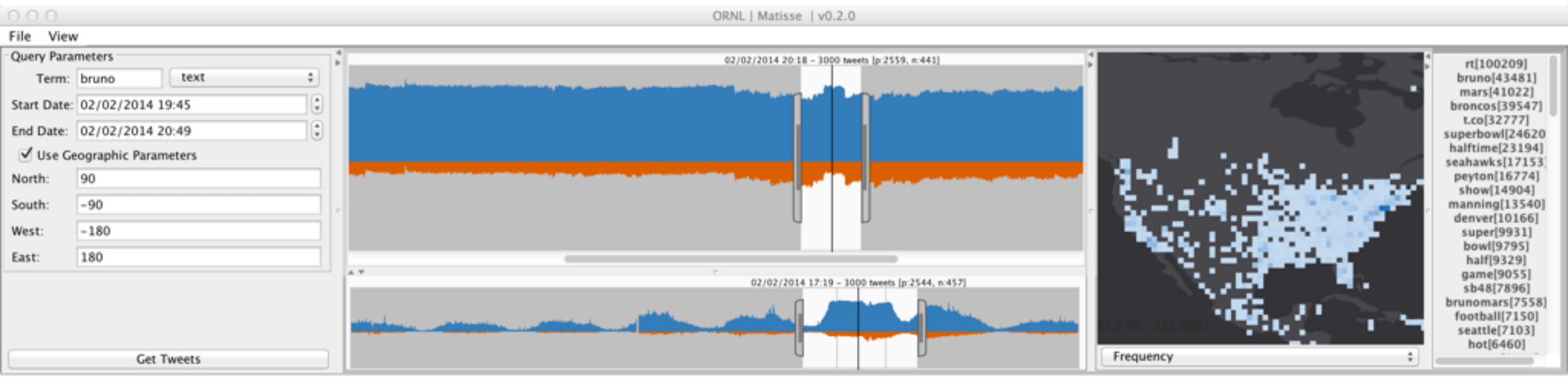
Emotion Classification using Machine Learning

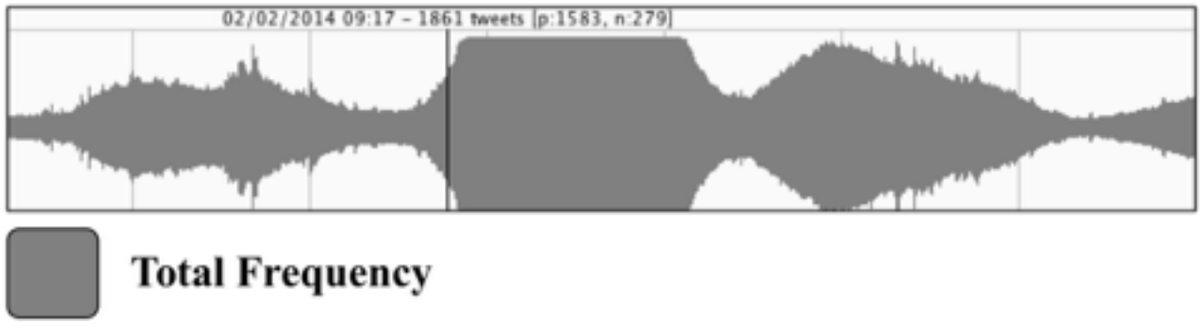
- TF-ICF term weighting method predicts significant terms using a vector space model
- Significant terms and ANEW scores are merged as a feature set representative of the content and emotion of the textual record
- A maximum entropy learner from the MinorThird ML library is used to train the model
- Training process selects tweets with emotion class explicitly encoded as a hashtag
    - Provides pure representations of each emotion class for automated labeling.
- Classifier is built to predict emotion in new unlabeled records

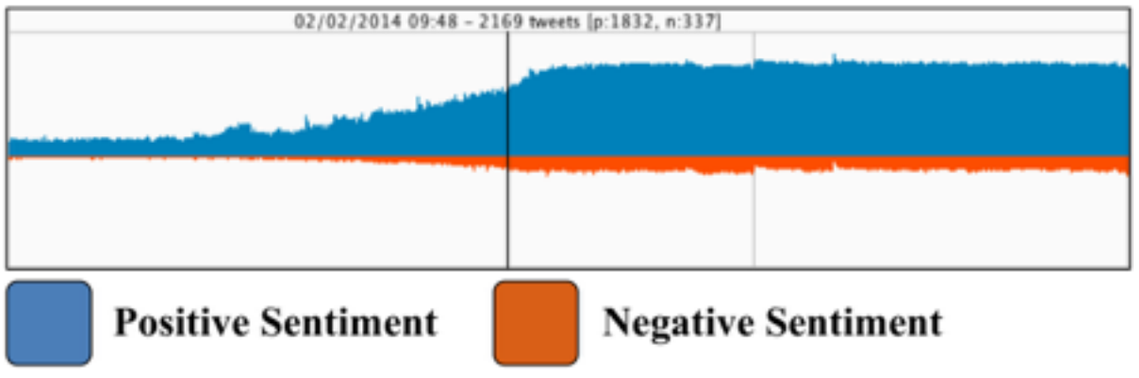
Geospatial + Term Frequency Visualizations



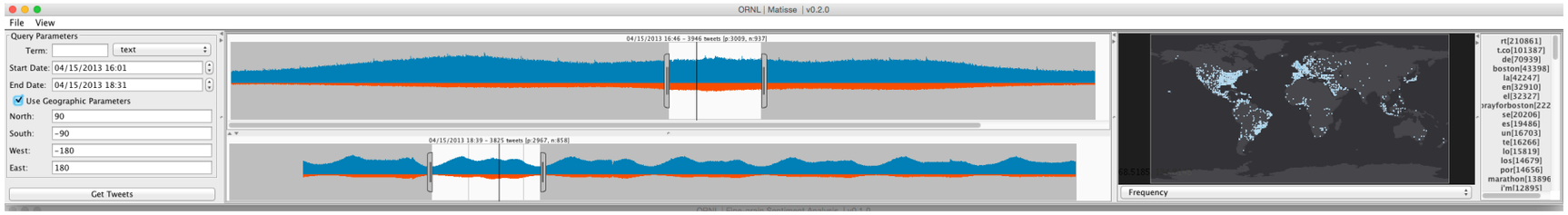
Multi-scale Temporal Visualizations

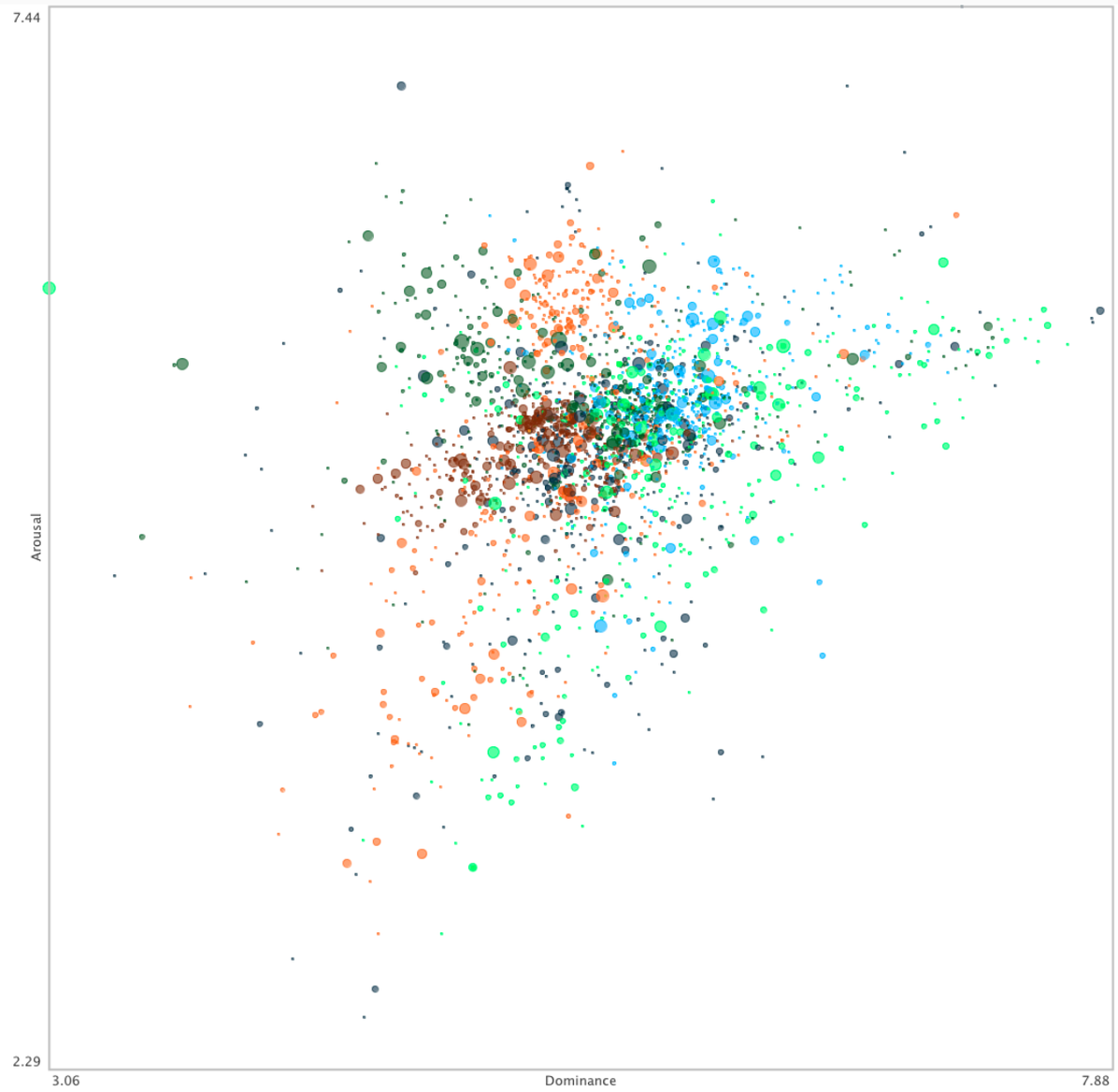




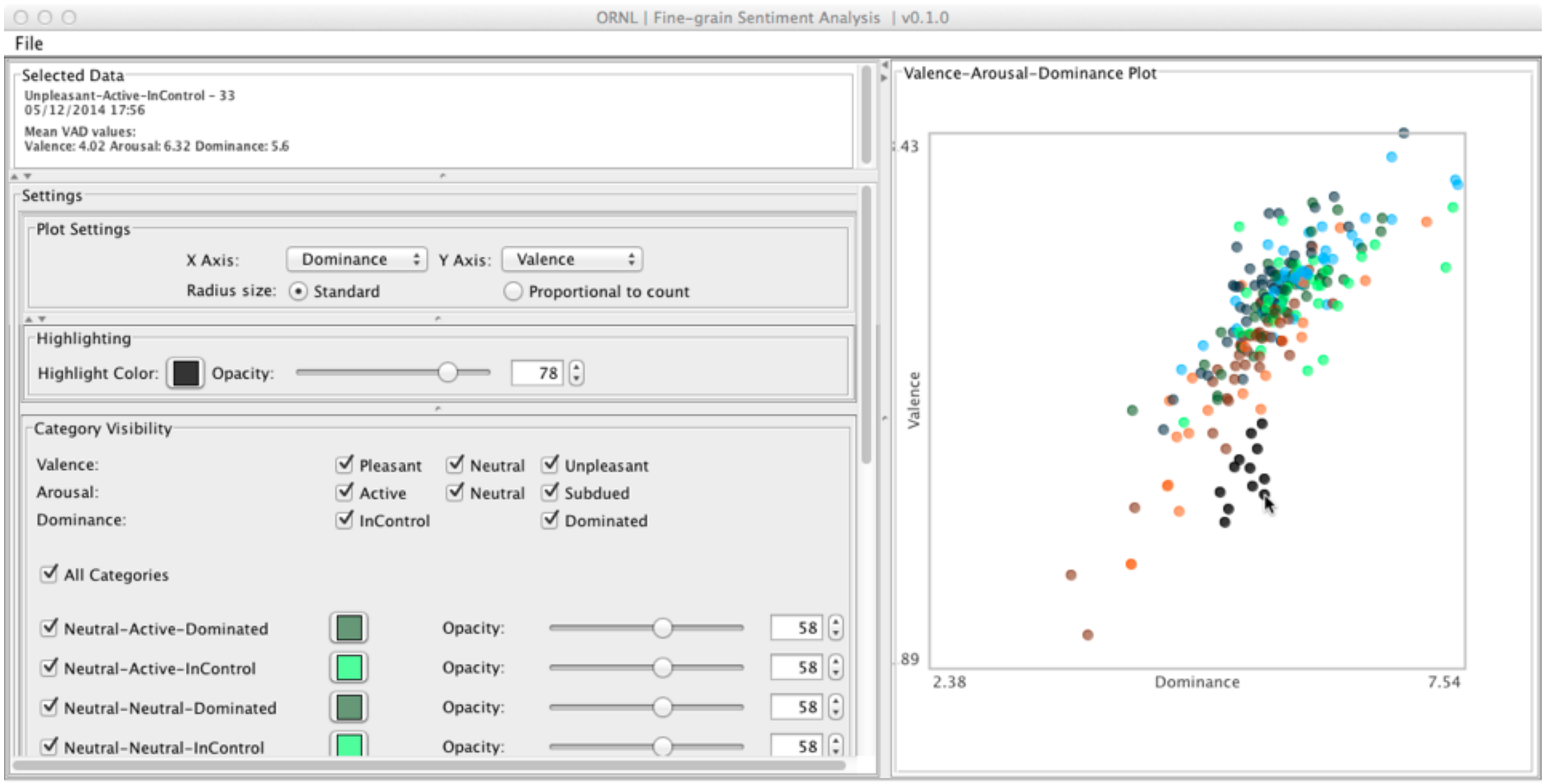


Visualizing Emotion Classifications

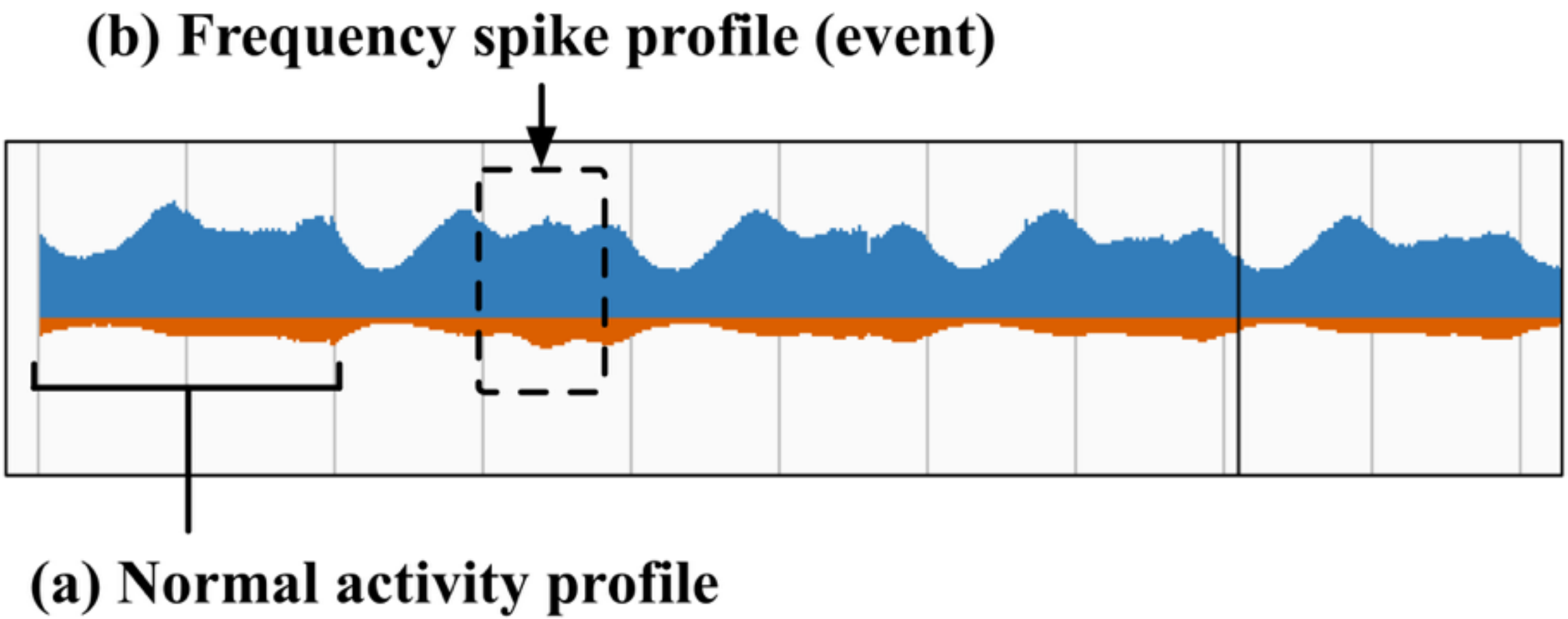




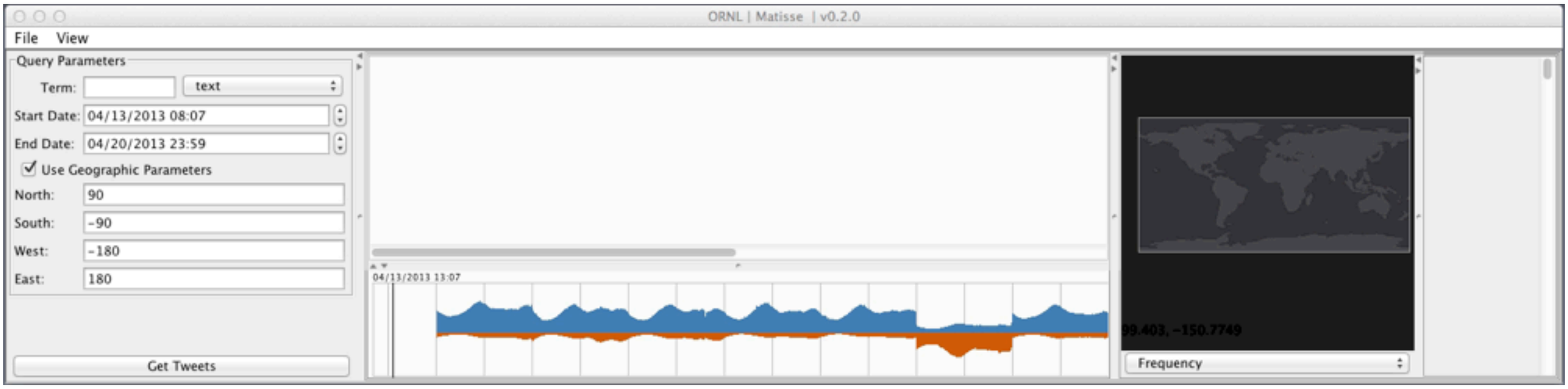
Visualizing Emotion Classifications



Temporal Event Detection



Case Study: Boston Marathon Bombing



Twitter 1% Sample Stream
Week of Boston Marathon Bombing
14-20 April, 2013

Conclusions

- Multi-scale visualizations enable scalable exploratory analysis
  - More intermediate views and scaled analytics will improve
- Automated analytics (sentiment / emotion) help guide analysis
  - ML emotion classification needs validation
- Linked views and interactions foster more creative analysis.
  - Additional views and interactions can help (e.g., graphs)