

# From Multimedia Data to Situation Detection

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## Categories and Subject Descriptors

H.5.1 [Multimedia Information Systems]:

## General Terms

Design, Measurement

## Keywords

Events, Situation Modeling, Detection, Social Networks

## EXTENDED ABSTRACT

We are witnessing a phenomenal increase in multimodal human and device sensing to measure and report parameters such as temperature, vehicle speed, visual experiences, flu cases, and people happiness. Soon we expect these *heterogeneous* datasets (e.g. images, videos, weather sensors, check-ins and tweets) to become available in *real-time* in the *Cloud* for reasoning and decision making.

Important human decisions however cannot be undertaken by piecemeal treatment of these individual data points. Rather we need computational tools to *integrate* and *abstract* these data points into higher level actionable representations.

This underscores the need for computational tools to model and detect *situations* from large heterogeneous spatio-temporal data sets. In this thesis, we computationally define the notion of *situations* and propose a methodology to bridge the semantic gap between the widely available low level *spatio-temporal* data and actionable situation inference needed for decision making.

We define a situation as:

*“An actionable abstraction of observed spatio-temporal descriptors”*

This definition underscores our viewpoint of computationally defining situations based on statistical *descriptors* (as opposed to say situation-calculus or recognition-by-parts), a focus on *spatio-temporal* data (which is indeed the most common connotation associated with situations), scoping of problem only to *observable* (via human/device sensors) data, and a focus on *actionable abstractions* (as defined explicitly by human domain experts).

The problem of modeling and detecting situations from (*STT*) *i.e. spatio-temporal-thematic* data is relevant in multiple domains like traffic, weather, healthcare, business analysis, emergency response, and political decision making.

## Situation Modeling

STT data spreads across very disparate application domains as well as data types. However, focusing on the commonalities and not the differences, we realize that there is a core set of operations

which is central to defining spatio-temporal *situations* across different applications. Once a domain expert defines a situation of interest (e.g. a ‘flu pandemic’, ‘hurricane advise’) based on data sources, core operations, and user parameters, the same situation model can act as a standing query on realtime data streams and provide ‘mass-personalization’ to billions of end-users.

Just like E/R modeling, or UML we merely provide the basic building blocks. It is each domain expert’s responsibility to define actionable situations by combining these building blocks. These building blocks are designed to be *computable*, *modular* and *explicit* and hence translatable into executable code once the modeling is complete.

## Approach

Our approach for integrating and characterizing heterogeneous spatio-temporal data is based on the concept of *social pixels*. We simply organize spatio-temporal values related to any theme on a two dimensional data grid. Such a grid provides heat-map like intuitive visualization, and also an *image* like computational data structure. Hence multiple spatio-temporal situational descriptors can be implemented as off-the-shelf image and video processing operations (Refer Fig 1).

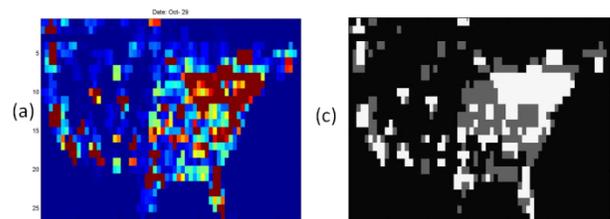


Figure 1(a) A representation for number of ‘flu’ reports on Twitter across continental USA (b) Data segmentation into high, mid, low activity zones

## Current status

We have made progress in terms of identifying the generic set of situation detection operations [1]. We have run multiple experiments with STT data sets to answer situational queries like ‘what recommendation to give to user indicating flu-like symptoms’ [2] and ‘where to open a new iphone store’[1]. We are currently implementing the core STT analysis engine which will allow modeling and detection of multiple situation queries across applications. We are also finalizing a methodology to guide domain experts when they model situations in terms of building blocks like data sources, characterizations operators, and user parameters.

## REFERENCES

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