

## **Declaration of Belfast**

Social Signal Processing (often abbreviated to SSP) is an emerging field. The aim of this declaration is to express the way the field is understood by people who are currently active in it. They have come into the field from diverse discipline backgrounds, and are members of the SSPnet Network of Excellence. It is normal that the exact boundaries of a field become clearer as research progresses, and SSP can be expected to follow the same pattern.

### **Brief statement**

Social Signal Processing studies signals (in a broad everyday sense of the word) that

- are produced during social interactions;
- that either play a part in the formation and adjustment of relationships and interactions between agents (human and artificial)
- or provide information about the agents;
- and that can be addressed by technologies of signal processing and synthesis.

It is a collaboration between research traditions in technology and human sciences, increasingly developing an interdisciplinary identity.

### **Key goals of SSP research**

The goals of SSP research can be classified under three headings: technological goals, human science goals, and practical impact goals.

#### *Technological Goals*

- 1) To develop systems capable of detecting and interpreting behavioural patterns that carry information about human social activity (analysis).
- 2) To develop systems capable of synthesising behavioural patterns that carry socially significant information to humans (synthesis).
- 3) To develop systems capable of using patterns that carry socially significant information to synthesise appropriate behaviours in an interaction (responsiveness).

#### *Human Science Goals*

- 1) To develop theories regarding the use of social signals during human-human interactions that can inform artificial agent behaviour, and can inform human-computer interactions.
- 2) To contribute to the human science literature by modifying current theories and proposing new theories informed by the computational research in SSP
- 3) To create databases suitable for the analysis of human-human interactions, and suitable for training synthesis systems.

- 4) To develop representational systems that describe human social behaviour and cognition in ways that are appropriate to technological tasks (such as labelling databases).
- 5) To develop methods of measuring & evaluating social interactions (human/human and human/machine).
- 6) To develop sophisticated tools for instrumenting human science research

### *Practical Goals*

Application of the research is not restricted to a narrowly predefined set of issues. It aims to address practical problems in a range of areas. Application has already begun in some areas, and others can easily be foreseen. Natural application areas include

- Artificial agents (e.g. for advertising, customer services)
- Ambient intelligence
- Artificial companions
- Assisted living
- Entertainment
- Education
- Human-computer interactions
- Monitoring in health care
- Social skills training
- Multimedia indexing

### **Key topics**

Research in Social Signal Processing recognises the significance of a wide range of topics that have been studied in the human sciences. Some of these define topics that are likely to be the focus of particular projects in SSP; others are overarching in the sense that they affect most SSP research. Many of them are reflected in the thematic work packages in the SSP Network. The following list identifies some of the key topics.

- The range of relevant signals
- The ways in which signals interact and combine in real interactions
- The ways in which signals depend on culture & social identity, and carry information about them
- The ways in which signals depend on power relations, and carry information about them
- The ways in which signals indicate deception & authenticity
- The ways in which signals contribute to influence, credibility & persuasiveness
- The role of context in the production and interpretation of social signals
- The relationship between voluntary and involuntary signalling
- The relationship between awareness of social signals and response to them
- The nature of social meaning

## Key challenges

The domain of SSP has specific challenges arising from the nature of the research and to the strong collaboration between human sciences and technology research. The challenges are not only achievable, but should be considered paramount to the success of SSP research and the SSP Network. A list of the core challenges is provided.

- To develop suitable database resources
- To match existing databases with available technologies, i.e.
  - to develop technologies that can work with existing (and conceivable) databases
  - to develop databases that can work with existing (and conceivable) technologies
- To collect knowledge about the patterns of signals to be analysed and synthesised that is at an appropriate level of detail to inform SSP technologies
  - existing literatures often do not approach the necessary level of detail
- To develop models of individuality (e.g. personality, culture, identity, stance) that are suited to computational work
- To develop models of impression formation that are suited to computational work
- To develop methods of modelling behavioural dynamics
- To develop analyses that capture causal relationships
- To develop suitable ‘mid-level’ perception techniques (e.g. constancy, segregation)
- To develop controllable, high-quality synthesis techniques

## Emerging balances

Some issues with a significant bearing on the character of the field are still a matter of debate. Although they have not been decisively resolved, the profile of activity in SSPnet implies that it tilts towards a particular kind of balance. Key examples are the following.

- Is language included?  
From a human science standpoint, language is the social signal *par excellence*, and should obviously be included. Technologically, there is an obvious motive to avoid it: the natural medium of language, speech, is very difficult to handle. The balance implicit in SSPnet is that language needs to be addressed, using transcripts if necessary: however, it is legitimate to give special attention to tasks where the limitations of language processing are not critical.
- How should naturalness and artificiality be balanced?  
Research in some related areas has relied heavily on data from actors or laboratory tasks, because naturalistic data is too difficult to find or to analyse. In return, some critics imply that only research on totally natural data is of any value. The balance implicit in SSPnet is that naturalness is a matter of degree. Simulation is acceptable, and probably practically necessary, so long as the signs in question are actually being used in an appropriate kind of interaction.
- What are the appropriate criteria of validity?  
Research in some traditions insists that data should be associated with a clear ground truth. In SSP that leads to very difficult demands – asking, for instance, what a person *really* felt or intended in a particular situation. A common alternative is to require high inter-rater agreement. That, too, is problematic, because it is a feature of some social signals that different people ‘read’ them in different ways. The balance implicit in SSPnet is that the appropriate test depends on the application.

## **Interactions between SSP and other disciplines**

It is an integral part of establishing SSP to establish appropriate relationships with related disciplines.

One key issue is recognising how much SSP stands to gain from older disciplines. Resources that it can assimilate include not only knowledge (see above), but also techniques (e.g. labelling, experimental designs, standard measures), representational devices (e.g. markup languages), and technical vocabulary.

The interaction between SSP and these disciplines should not be one-sided. SSP research could and should also contribute to other disciplines and help to inform them. The interdisciplinary nature of SSP research provides an incentive to explore ways of integrating material from different disciplines. Attempts to implement ideas also classically contribute to understanding their limitations. SSP also offers disciplines that can be seen as esoteric new kinds of practical application.

The interaction also needs to acknowledge academic realities. The discipline will not retain active input from specialists in a related discipline unless they are able to publish articles that are recognised as contributions to their home discipline.

## **Ethical obligations**

SSP deals with issues that are ethically sensitive. As a result, it has a range of ethical obligations. Many are standard, but some are not.

Obligations that are shared with many other fields include

- avoiding distress, deception and other undesirable effects on participants in studies
- maintaining the confidentiality and anonymity of participants involved in the research
- avoiding the development of systems that could reasonably be regarded as intrusive
- limiting opportunities for abuse of the systems that they develop (probably through licensing arrangements)

Particular obligations arise from the combination of complexity and sensitivity that is associated with social signals. The general requirement is sensitivity to the ways that social communication can affect people. Applying that to specific cases depends on intellectual awareness

- of individual issues (personality, age, etc)
- of cultural issues (norms, specific signs, etc)
- of general expectations (what is disturbing, humiliating, etc)

Communicating about the area to non-experts raises particular issues. People are prone to systematic misunderstanding of SSP-type systems, so that they rely on them when they ought not to, fear them when they have no need to, and so on. Obligations relevant to offsetting that are

- honesty, i.e. ensuring that what is said about a system is true;
- modesty, i.e. taking pains to ensure that its limitations as well as its achievements are understood;
- public education, i.e. trying to equip people with the background knowledge to grasp what a particular system might or might not be able to do.