

Computational modelling of emotion: Overview of papers

Contemporary emotion modelling includes many projects attempting to understand natural emotions or to implement simulated emotions in chatbots, avatars or robots, for practical uses of many sorts from entertainment to caring. The numerous models of affective phenomena in the literature differ in important respects. They differ in how they describe and explain a range of phenomena, including the nature and order of perceptual, cognitive and emotional mental processes and behavioural responses in emotional episodes. They also differ in their target level of granularity: from fine-grained neural to coarse-grained psychological. Different models simulate emotions (and other mental states) with different ontological status and with a different focus on whether they model external behaviour or internal states. The papers in this symposium reflect this range of approaches, coming from computer science and robotics to psychology and philosophy.

Both theoretical approaches and applications are amongst the papers in the Computational Modelling of Emotion symposium. A number of papers in the symposium take an evolutionary approach to explaining emotion. The keynote talk by Aaron Sloman theorises about the different sorts of information processing architecture which can result from varying developmental and epigenetic trajectories over evolution. These differing information processing architectures then have the potential to experience different sorts of emotion. Following the 'evolution and emotion' theme, two further papers discuss results from iterated prisoner's dilemma simulations related to the evolution of moral sentiments such as guilt, revenge, apology and forgiveness. In these papers, implications from the evolutionary emergence of such sentiments for inter-agent cooperation is discussed (Pereira, Lenaerts, Vaquero and Han; and, Lenaerts, Han, Pereira, and Vaquero). With an alternative mathematical approach, Donsimoni models psychological fatigue in the context of a labour supply problem, showing how fatigue interacts with resilience in influencing work output.

A number of papers discuss architectural issues in emotion modelling. Petters and Waters present a historical review of Bowlby's attachment control system, showing that what Bowlby conceived between the 1960s and 1980s is in many respects a surprisingly contemporary framework for emotional architectures. Beaudoin, Hyniewska and Hudlicka consider how emotional perturbation arises in information processes architectures and consider how the concept of perturbation helps explain emotions such as grief and limerence (the attraction stage of romantic love) and other emotions with repetitive and intrusive mentation. Broekens assesses the prospects of emotional architectures based on reinforcement learning. He considers that emotions may emerge from the operation of reinforcement learning mechanisms. This raises the question: 'can any agent implementing reinforcement learning mechanisms be considered to possess an implicit emotion model?'. Caspar and Moore relate emotions to survival processes. They present a neural circuit architecture for emotion and compare its performance in terms of survivability with a previous model.

In the symposium there are several papers related to theoretical or applied aspects of attachment modelling. Petters and Coyne-Umfreville consider that whilst personality-like states might be modelled as control states, most computational models of personality instead merely attempt to imitate superficial behavioural aspects of personality. They go on

to present as a position paper the proposal that adult attachment patterns seen in conversational interviews might be modelled using information processing architectures with particular meta-cognitive and memory encoding and retrieval mechanisms. In contrast with the other architectural approaches to emotion, Truschzinski and Klein present the advantages of taking a dynamical systems and enactive approach to emotion modelling.

The symposium papers concerned with emotion modelling applications complement the theoretical and architectural focus of the papers described above. Many of these 'applications' papers have a clear relationship to the theory and architectural papers. For example, Cittern, Edalat and Ghaznavi; and, Shemmings (presentation without a paper in proceedings) both discuss technologically supported attachment interventions which complement the theoretical attachment modelling papers by Petters and Waters; and Petters and Coyne-Umfreville.

Tanevska, Rea, Sandini and Sciutti present results on emotion and human robot interaction which model emotion in two senses. Firstly, the robots perceive human emotions. So forming emotion models of the humans they interact with to better direct robot actions. In addition, the robots incorporate an emotion-driven motivation and learning system. Thus demonstrating another example of the close interaction of theoretical, architectural and applied aspects of emotion modelling. Both Dente, Kuester, Skora and Krumhuber; and, Dupre, Booth, Bolster, Morrison and McKeown, describe face recognition emotion models which utilises machine analysis of a large number of human faces. From faces to language - Seyeditabari, Levens, Maestas, Walsh, Danis and Zadrozny describe algorithms for large-scale text data analysis of emotions with the purpose of studying emotion contagion through social media networks.

Taken together the collected papers of the symposium discuss a wide range of computational models and a wide range of specific emotions, affective states and moral sentiments. These include: motives, attachments, moods, guilt, revenge, apology, forgiveness, fatigue, resilience, capacity for recuperation, grief, love, hope, fear, happiness, sadness, avoidance, preoccupation, trust, anger, surprise, disgust, shock, anxiousness, sympathy, frustration, feeling betrayed, and pride. It is hoped presenting the state of the art in emotion modelling and bringing such diverse papers together in the Computational Modelling of Emotion symposium at AISB2017 facilitates movement towards a mature integrated field. This should possess a deeper and richer understanding of biological minds; clearer interrelationships between contemporary emotion models; and fruitful use of emotion models in real world applications.