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PUBLICATION-BASED PRESENTATION: Modeling Human Creative Cognition using AI Techniques

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DiPaola's research endeavors to build top down Artificial Intelligence (AI) models of human creativity, empathy and expression for both use in new forms of computation systems as well as analysis of how the creative mind works. In doing so he has interviewed hundreds of artists, writers and musicians on how they perceive their creative talent and its originals. Combined with research from neuro-aesthetics and computer modelling, DiPaola notes that while many creative individuals report that they believe new insights as coming into them from an external source during creative flow, that evidence point to these new creative ideas and interpretations often more likely have internal roots from the individual's, mid and long term past experiences and processes. DiPaola attempts to model this and other human creativity processes in computational form often as AI systems such as deep learning, reinforcement learning and evolution programming. Two efforts underway in DiPaola's research lab are mapping out the creative process of a fine art portrait painter using 5 hierarchical AI systems, as well as modelling an empathetic embodied character agent who can understand emotions from those she talks with and construct creative narrative or quote like responses.

The common view that our creativity is what makes us uniquely human suggests that incorporating research on human creativity into Artificial Intelligence (AI) based generative deep learning techniques might be a fruitful avenue for making their outputs more compelling and human-like, especially in arts such as the creative arts. Using our labs original AI systems such as our deep learning convolutional neural networks and cognitive based computational art rendering systems, we attempt to show how human creativity can be implemented/modelled computationally, and demonstrate their impact on the resulting digital generative art. Conversely, he will discuss how explorations in creativity AI can inform our understanding of human creativity and its foundations.

DiPaola will discuss and demonstrate his lab's approach (ivizlab.sfu.ca) to cognitively modeling a fine art painter process by integrating Deep Learning AI with novel computational novel NPR approaches. This interdisciplinary (cognitive science / arts / AI) work brings cognitive creative fields together with Deep Learning neural networks. DiPaola will demonstrate and discuss the lab new work as well as the applications spaces in interactive arts, health and a recent Google / Knight Foundation granted project using creative painterly emulation as a new approach to anonymize interviewees in documentary videos where the study data shows improvement to overall empathy and engagement compared to current techniques.

Steve DiPaola, past Director of the Cognitive Science Program at Simon Fraser University (SFU), is currently is a Professor and lab director of the iVizLab, a PhD based lab on Artificial Intelligence using human cognition theories of creativity, empathy and expression. He came to SFU from Stanford University where some of his creative AI systems were used in generative game creation including the best-selling game of that year, "The Sims". DiPaola has over 100+ peer reviewed papers in AI/cognition and $2 million in past/current funding in AI related areas of cognitive creativity and expression. As both a scientist and artist, DiPaola has written code for his AI "creative on its own" artworks that has been shown in major galleries and museums including The Whitney, The Smithsonian, Tate, and gallery's in NYC, London and LA.
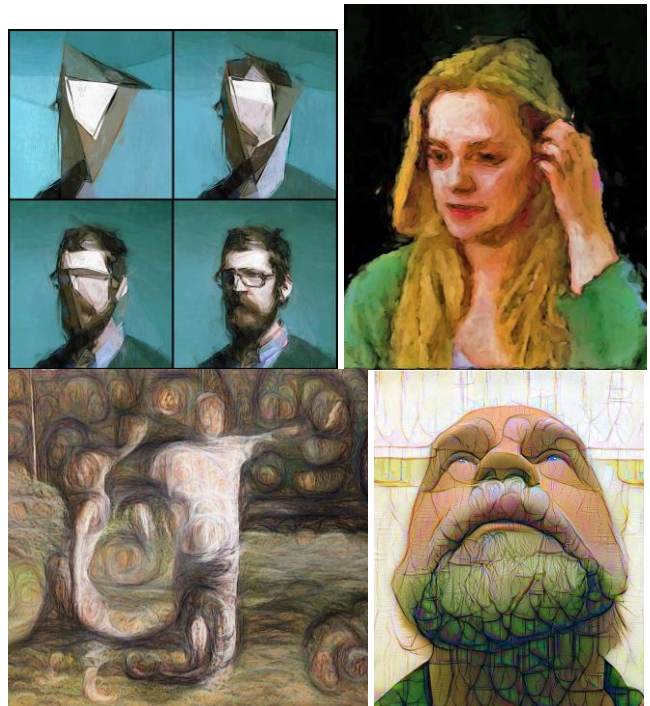
DiPaola Papers

Journals:

- DiPaola S, McCaig G, Gabora L, (2018). Informing Artificial Intelligence Generative Techniques using Cognitive Theories of Human Creativity. Procedia Computer Science. Special Issue: Bio Inspired Cognitive Arch. Vol 145 pp 158-168.
- DiPaola S, (2017) Exploring the Cognitive Correlates of Artistic Practice Using a Parameterized Non-Photorealistic Toolki", Leonardo, Winner of 2016 LABS Leonardo Award. Vol. 50, pp 531-452.
- Shakeri H, Nixon M, & DiPaola S, (2017) Saliency-Based Artistic Abstraction with Deep Learning and Regression Trees, Journal of Imaging Science and Technology, Vol 61, No 6, pp. 60402-1-60402-9(9), 2017.
- DiPaola S, (2014)Using a Contextual Focus Model for an Automatic Creativity Algorithm to Generate Art Work, Procedia Computer Science. Special Issue: Bio Inspired Cognitive Architectures, Vol 41, pp. 212-219..
- DiPaola S, Riebe C, Enns J T, (2013) Following the masters: Portrait viewing and appreciation is guided by selective detail, Perception, Vol 42, No 6, pp 608–630.
- DiPaola S, Riebe C, Enns J, (2010). Rembrandt's Textural Agency: A Shared Perspective in Visual Art and Science", Leonardo, Vol 43, No 3, pp 145-151.
- Riebe C, DiPaola S., & Enns J, (2009). Following The Masters: Viewer Gaze is Directed by Relative Detail in Painted Portraits, Journal of Vision, Vol 9, No 8, pp 368-368.
- DiPaola S, Gabora L, (2009). Incorporating Characteristics of Human Creativity into an Evolutionary Art Algorithm, Genetic Programming and Evolvable Machines Journal, Vol 10, No 2, pp 97-110.

Conference Papers

- Feldman S, Yalcin ON, DiPaola S, (2017). Engagement with artificial intelligence through natural interaction models, Proc: Electronic Visualisation and the Arts, British Computer Society, 296-303.
- McCaig R, DiPaola S, Gabora L, (2016). Deep Convolutional Networks as Models of Generalization and Blending Within Visual Creativity, Proceedings of International Conference on Computational Creativity, 8 pages.
- DiPaola S, McCaig R, (2016). Using Artificial Intelligence Techniques to Emulate the Creativity of a Portrait Painter, Proceedings of Electronic Visualisation and the Arts, British Computer Society, 8 pages, London.
- Choi S K, DiPaola S, (2015). Touch of the Eye: Does Observation Reflect Haptic Metaphors in Art Drawing?, Proceedings of ACM Conf on Human Factors in Computing Systems (CHI '15), pp 579-588.
- Salevati S, DiPaola S, (2015). A Creative Artificial Intelligence System to Investigate User Experience, Affect, Emotion and Creativity, Proceedings of Electronic Visualisation and the Arts, British Computer Society, 8 pages, London.

- DiPaola S, (2014). Computer Modelling Fine Art Painting using a Cognitive Correlative Heuristics Approach, Proceedings of Biologically Inspired Cognitive Architectures. 5 pages. MIT, MA.
- Salevati M, DiPaola S, (2014). Using a Creative Evolutionary System for Experiencing the Art of Futurism, Proceedings of Electronic Visualisation and the Arts, Florence, Italy, 8 pages.
- Choi S K, DiPaola S, (2013). How a Painter Paints: An Interdisciplinary Understanding of Embodied Creativity, Proceedings of Electronic Visualisation and the Arts, pp. 127-134. British Computer Society, London.
- DiPaola S, Smith A, (2013). Interactively Exploring Picasso's Multi-dimensional Creative Process in Producing Guernica, Proceedings of Electronic Visualisation and the Arts, pp. 25-31. British Computer Society, London.
- Gabora L, DiPaola S, (2012). How Did Humans Become So Creative? A Computational Approach, Proceedings of International Conference on Computational Creativity, pp 203-211.
- DiPaola S, Smith A, (2012). Formalizing An Interconnected Syntax For Picasso's Creative Process In Producing Guernica", Proceedings of Conceptual Structure, Discourse and Language, 6 pages.
- Choi S K, DiPaola, S, Schiphorst T, 2012. The Tacit And The Trace: Towards Syntax Of The Creative Act, Proceedings of Conceptual Structure, Discourse and Language, 6 pages.
- DiPaola S, (2009). Quantifying artist's use of human vision constructs to influence viewer eye gaze,", In Proc: SPIE Human Vision and Imaging, Int. Society for Optical Engineering, 6 pages.
- DiPaola S, (2008). "The Trace and the Gaze: Textural Agency in Rembrandt's Late Portraiture from a Vision Science Perspective", Proceedings of Electronic Visualisation and the Arts, 8 pages, London.
- DiPaola S, Gabora L, (2007). Incorporating Characteristics of Human Creativity into an Evolutionary Art Algorithm", In Proceedings of the 2007 GECCO Conference Companion on Genetic and Evolutionary Computation (London,, July 07 - 11, 2007). GECCO '07, pp 2450-2456., ACM, New York, NY.
- DiPaola S, (2007). A Knowledge Based Approach to Modeling Portrait Painting Methodology, Proceedings of Electronic Visualisation and the Arts, 10 pages, London.
- DiPaola S, (2007). Painterly Rendered Portraits from Photographs using a Knowledge-Based Approach", In Proc: SPIE Human Vision and Imaging, Int. Society for Optical Engineering, Keynote paper. pp 33-43.
- DiPaola S, (2006). Evolving Portrait Painter Programs using Genetic Programming to Explore Computer Creativity", Proceedings of iDMAa Conference (International Digital Media and Arts Association), 7 pages.
- DiPaola S, (2005). Evolving Creative Portrait Painter Programs Using Darwinian Techniques with an Automatic Fitness Function", Proceedings of Electronic Visualisation and the Arts, 10 pages, London. July.