

Overview & Recent Publications

Who We Are

A spin-out from Imperial College London, the R&D Group @ Cortexica has been operating for over 10 years, it now comprises of 30+ research scientists and engineers with a variety of backgrounds; from computer vision, machine learning, neuroscience to astrophysics and medical imaging.

The group has expertise in various Artificial Intelligence, Deep Learning, Machine Learning, Geometric and Statistical techniques. This drives sophisticated AI solutions for our clients and simply put; "World-class best-of-breed technology". This results in delivering the fastest, most-efficient and highest accurate capabilities for both image and video comprehension available today.

Ecosystem - Partners & Grants

We believe no one party can solve this alone and have strategic partnerships with several industry and public sector partners. Our Global 2000 clients and partnership grants in affect steer a large portion of the group's research agenda.

Publications

Cover well-known journals (PAMI, JOSA, Phys Rev E, PloS Computational Biology/Biology, Neuroimage, Royal society journals, etc.) and respected conferences such as NIPS, CoSyNe, AISTATS, ECCV, ICCV, etc. The group is structured into, i) Applied, and ii) Theoretical teams, with a commercial focus and support for our clients' AI roadmaps.

Applied Research

1. Infrastructure Optimization

Utilizing differential geometry, we have shown how rankings on a set of such images can be improved by using Wasserstein distances. Further on, bringing on ideas from tensor factorization, we have shown that these images can be encoded to save storage footprint along with producing encodings that have at par retrieval performance as that demonstrated by advanced methodologies such as Fisher encodings.

2. Ranking of Images

On the very end of applied research, we have productized a deep learning based recommendation framework that can provide suggestions to end-users based on their personal preference of colour, texture, style for a variety of apparels.

3. Video Behavioural Analysis

Our "pillar networks" for video based action recognition have demonstrated state-of-the-art predictions on data-sets that have varying camera viewing angles, video quality, etc.

Theoretical Research

4. Hybrid approach combining Differential Geometry with Statistical Bayesian techniques

Our ICML workshop papers have concentrated on fusing differential geometry based parallel transport with variational Bayes, apart from coming up with a Bayesian belief updating scheme to predict spatiotemporal dynamics such as seizures that originate in the cortex of epileptic patients.

5. Reinforcement learning for human decision making

In other unpublished work, we have looked into active inference, a neuroscience aided reinforcement learning framework, for agents that are spread on a spatiotemporal field – using PDE analysis and optimal transport theory. This has significant consequences for reinforcement learning, deep and otherwise, which has always ignored the spatial structures of agents.

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Workshops

1. A. Creswell, T. White, V. Dumoulin, K. Arulkumaran, B. Sengupta and A. Bharath "Generative Adversarial Networks - An Overview" *IEEE Signal Processing Magazine* (in press, 2017)
<https://arxiv.org/abs/1710.07035>
2. Y. Qian, P. Giaccone, M. Sasdelli, E. Vazquez and B. Sengupta "Algorithmic clothing: hybrid recommendation, from street-style-to-shop" *Proceedings of KDD 2017 (Machine learning meets fashion workshop)*
<https://arxiv.org/abs/1705.09451>
3. B. Sengupta, Y. Qian and E. Vazquez "Deep Tensor Encodings" *Proceedings of KDD (Machine Learning for Fashion workshop) Proceedings of KDD 2017 (Machine learning meets fashion workshop)*
<https://arxiv.org/abs/1703.06324>
4. G.K. Cooray, R. Rosch, T. Baldeweg, L. Lemieux, K.J. Friston and B. Sengupta "Bayesian belief updating of spatiotemporal dynamics" *Proceedings of ICML 2017 (Time Series workshop)*
<https://arxiv.org/abs/1705.07278>
5. B. Sengupta and K.J. Friston "Approximate Bayesian inference as a gauge theory" *Proceedings of ICML 2017 (Computational Biology workshop) – spotlight presentation*
<https://arxiv.org/abs/1705.06614>
6. B. Sengupta and Y. Qian "Pillar networks for action recognition" *Proceedings of IROS (Workshop on Semantic Policy and Action Representations for Autonomous Robots), Canada 2017*
<https://arxiv.org/abs/1707.06923>
7. B. Gajic, E. Vazquez and R. Baldrich "Evaluation of Deep Image Descriptors for Texture Retrieval" *VISIGRAPP (5: VISAPP) 2017: 251-257*
8. V. Simaiaki, A. Mirabile and E. Vazquez "Flower identification on species level with uneven classes and few images" *BMVA 2017 Plants in Computer Vision workshop*
9. B. Sengupta and Y. Qian "Multi-kernel deep learning of deep convolutional features for action recognition" *LSMDC (Video and Language Understanding Workshop) ICCV2017*
<https://arxiv.org/abs/1707.06923>
10. B. Sengupta and Y. Qian "Pillar Networks: Distributed non-parametric deep and wide networks" (PAIR in AAAI2018)
<https://arxiv.org/abs/1708.06250>
11. A. Bay and B. Sengupta "StackSeq2Seq: Dual Encoder Seq2Seq Recurrent Networks" (HeteroNAM in WSDM2018)
<https://arxiv.org/abs/1710.04211>
12. A. Bay and B. Sengupta "GeoSeq2Seq: Information Geometric Sequence-to-Sequence Networks" (ICLR2018)
<https://openreview.net/forum?id=rJ4dWt6HM>
13. A. Bay and B. Sengupta "Homotopic deep recurrent neural networks for approximating meta-heuristics" (Theory of Deep Learning in ICML 2018)
<https://arxiv.org/abs/1709.02194>
14. Y. Qian, E. Vasquez and B. Sengupta "Differential Geometric Retrieval for Deep Learning", *HDM (High Dimensional Data Mining workshop) (ICDM2017)*
<https://arxiv.org/abs/1702.06383>

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Pre-prints

1. *B. Sengupta, E. Vazquez, V. Simaiaki, M. Sasdelli, Y. Qian, M. Peniak, L. Netherton, G. Delfino "Large-scale image analysis using docker sandboxing"*
<https://arxiv.org/abs/1703.02898>
2. *B. Sengupta and K.J. Friston "Sentient Self-Organization: Minimal dynamics and circular causality"*
<https://arxiv.org/abs/1705.08265>