IM931-15 Interdisciplinary Approaches to Machine Learning

20/21

Department
Centre for Interdisciplinary Methodologies
Level
Taught Postgraduate Level
Module leader
Michael Castelle
Credit value
15
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

N/A.

Module web page

Module aims

This module serves as an interdisciplinary introduction to contemporary machine learning research and applications, specifically focusing on the techniques of deep learning which use convolutional and/or recurrent neural network structures to both recognize and generate content from image, text, signals, sound, speech, and other forms of predominantly unstructured data. Using a combination of theoretical/conceptual/historical analysis and practical programming projects in the R programming language, the module will teach both the basic application of these techniques while also conveying the historical origins and ethical implications of such applications.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

- Week 01. Introduction: A Social History of Machine Learning.
- Week 02. Table to Symbol: Structured Data, Unsupervised Classification, and Organizations.
- Week 03. Sequence to Symbol: Text, Entextualization, and Contextualization.
- Week 04. Image to Symbol: Convolutional Neural Networks (CNNs), Supervised Classification, and Iconicity.
- Week 05. Image to Image: CNNs (con't.); DeepDream, Style Transfer, and Theories of Aesthetics.
- Week 06. Generative Adversarial Networks, Creative Ai, and the Habitus.
- Week 07. Sequence to Sequence: Recurrent Neural Networks (RNNs), Machine Translation, Structuralism and Poetics.
- Week 08. Signals: Speech, Sound, and Temporality.
- Week 09. Agency: Reinforcement Learning, Autonomous Agents, and Theories of Action.

Learning outcomes

By the end of the module, students should be able to:

- By the end of the module, students should be able to understand the methodology of machine learning and its techniques as applied to different forms of data.
- By the end of the module, students should be able to be able to critically evaluate claims regarding machine learning and artificial intelligence (AI).
- By the end of the module, students should be able to explain how and why different machine learning methods can be applied in different disciplines, and to understand the technical and ethical challenges within those different fields.
- By the end of the module, students should be able to apply those methods to basic deep-learning tasks like object recognition, text-based recommendation systems, and generative art.

Indicative reading list

Anderson, James A./Rosenfeld, Edward, editors: Talking Nets: An Oral History of Neural Networks. MIT Press, 1998.
Baltrušaitis, T., Ahuja, C., & Morency, L.-P. (2017). Multimodal Machine Learning: A Survey and Taxonomy. ArXiv:1705.09406 [Cs].
Belting, H. (2011). An Anthropology of Images: Picture, Medium, Body. (T. Dunlap, Trans.). Princeton: Princeton University Press.
Berger, John. 1972. Ways of Seeing. London: Penguin.
Bourdieu, P. 1977. Outline of a Theory of Practice. Cambridge: Cambridge University Press.
Breiman, L. (2001). Statistical Modeling: The Two Cultures.
Chollet, F. (2018). Deep Learning with R (1 edition). Shelter Island, NY: Manning Publications.
Dreyfus, Hubert L./Dreyfus, Stuart E.: Making a Mind versus Modeling the Brain: Artificial Intelligence Back at a Branchpoint. Daedalus, 117 1988, Nr. 1, 15–43
Deacon, Terrence W.: The Symbolic Species: The Co-evolution of Language and the Brain. W. W. Norton and Company, 1997.
Domingos, P. (2017). The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World. London: Penguin.

Dupuy, Jean-Pierre: On the origins of cognitive science : the mechanization of the mind. Princeton University Press, 2000
Elgammal, A., Liu, B., Elhoseiny, M., & Mazzone, M. (2017). CAN: Creative Adversarial Networks, Generating “Art” by Learning About Styles and Deviating from Style Norms. ArXiv:1706.07068 [Cs].
Espeland, Wendy Nelson/Stevens, Mitchell L.: Commensuration as a Social Process. Annual Review of Sociology, 24 1998, Nr. 1, 313–343
Gatys, Leon A., Alexander S. Ecker, and Matthias Bethge. 2015. “A Neural Algorithm of Artistic Style.” arXiv:1508.06576 [cs, Q-Bio], August. http://arxiv.org/abs/1508.06576.
Hayles, N. Katherine: How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics. University of Chicago Press, 1999
Haugeland, J.: Artificial Intelligence: The Very Idea. Cambridge, Mass.: MIT Press, January 1989.
Jakobson, Roman. 1971. “On Linguistic Aspects of Translation.” In Selected Writings II: Word and Language, 260–66. The Hague: Mouton.
Kockelman, P. (2013). The anthropology of an equation. Sieves, spam filters, agentive algorithms, and ontologies of transformation. HAU: Journal of Ethnographic Theory, 3(3), 33–61.
Krizhevsky, Alex/Sutskever, Ilya/Hinton, Geoffrey E.: ImageNet Classification with Deep Convolutional Neural Networks. 26th Annual Conference on Neural Information Processing Systems 2012.
Langley, Pat: The changing science of machine learning. Machine Learning 2011.
LeCun, Y. et al.: Backpropagation Applied to Handwritten Zip Code Recognition. Neural Comput. 1 December 1989, Nr. 4, 541–551.
Lévi-Strauss, Claude: Structural Anthropology. New Ed edition edition. New York: Basic Books, May 1974, ISBN 978–0–465–09516–2.
Lizardo, Omar: The Cognitive Origins of Bourdieu’s Habitus. Journal for the Theory of Social Behaviour, 34 December 2004, Nr. 4, 375–401.
Mackenzie, Adrian: The production of prediction: What does machine learning want? European Journal of Cultural Studies, 18 2015, Nr. 4-5, 429–445.
Mackenzie, A. (2017). Machine Learners: Archaeology of a Data Practice. Cambridge, MA: MIT Press.
Manning, Christopher D.: Computational Linguistics and Deep Learning. Computational Linguistics, 41 2015, Nr. 4, 701–707.
Rumelhart, David E./Hinton, Geoffrey E./Williams, Ronald J.: Learning representations by back-propagating errors. Nature, 323 October 1986, Nr. 6088, 533–536
Saussure, F. de. (1915). Course in General Linguistics. McGraw-Hill.
Selfridge, O. G.: Pattern Recognition and Modern Computers. In Proceedings of the March 1-3, 1955, Western Joint Computer Conference. New York, NY, USA: ACM, 1955, AFIPS ’55 (Western).
Silverstein, M. (2003). Translation, Transduction, Transformation: Skating “Glossando” on Thin Semiotic Ice. In P. Rubel & A. Rosman (Eds.), Translating Cultures: Perspectives on Translation and Anthropology (pp. 75–105). Oxford.
Stone, M: Cross-Validatory Choice and Assessment of Statistical Predictions. Journal of the Royal Statistical Society. Series B (Methodological), 36 1974, Nr. 2, 111–147.
Suchman, Lucy A.: Plans and situated actions : the problem of human-machine communication. Cambridge University Press, 1987.
Sutskever, Ilya/Vinyals, Oriol/Le, Quoc V.: Sequence to Sequence Learning with Neural Networks. arXiv:1409.3215 [cs], September 2014.

Underwood, T. (2015). The literary uses of high-dimensional space. Big Data & Society, 2(2).
Zeiler, Matthew D., and Rob Fergus. 2014. “Visualizing and Understanding Convolutional Networks.” In In Computer Vision–ECCV 2014, 818–33. Springer.

Interdisciplinary

One of the primary aims of the module is to enable students to develop an appreciation of multi-disciplinary approaches to machine learning, and to critically apprise these approachess using metthods drawn from a range of different disciplines.

Subject specific skills

- Demonstrate an appreciation of multi-disciplinary approaches to machine learning;
- Understand why particular machine learning methods are applied to particular forms of data in particular contexts;
- Discuss the ethical implications of the use of machine learning techniques and methodologies as applied to different fields;
- To innovatively extend knowledge and techniques to novel settings as they emerge.

Transferable skills

- Think critically and creatively;
- Meet regular deadlines;
- Demonstrate time-management skills;
- Demonstrate problem solving skills;
- Demonstrate independent learning skills;
- Participate in class discussions;
- Demonstrate and practice presentation skills;
- Present and report on group discussions;
- Experience and participate in both individual and team-based activities.

Study

Study time

Type	Required
Lectures	9 sessions of 2 hours (12%)
Other activity	9 hours (6%)
Private study	123 hours (82%)
Total	150 hours

Private study description

Prescribed reading and self-directed study for assessments.

Other activity description

Labs.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time
Laboratory Assignment and Report 2000 words.	40%	
Group Presentation Group presentation	10%	
Final Project and Report 2000 words.	50%	

Feedback on assessment

Laboratory Assignment/Report (Summative)\r\nWritten feedback.\r\n\r\nFinal Project Proposal (Formative)\r\nWritten feedback.\r\n\r\nFinal Project Report and Group Presentation (Summative)\r\nWritten feedback.\r\n

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Availability

Courses

This module is Optional for:

- Year 2 of TIMS-L990 Postgraduate Big Data and Digital Futures
- TIMA-L99A Postgraduate Taught Digital Media and Culture
    - Year 1 of L99A Digital Media and Culture
    - Year 2 of L99A Digital Media and Culture
- Year 1 of TMAA-G1PF Postgraduate Taught Mathematics of Systems

- Year 1 of TIMA-L99D Postgraduate Taught Urban Analytics and Visualisation

This module is Option list A for:

- Year 1 of TIMS-L990 Postgraduate Big Data and Digital Futures