

# **Computational Cognitive Science 2**

## **Multimodality in Communication and Cognition**

### **Teaching plan**

Spring 2024

**Schedule:** Wednesdays 11:15-13:00

**Classroom:** 23.3.47

**Lecturers:** Patrizia Paggio (PP) and Costanza Navarretta (CN)

The course combines lectures, student presentations, group work and hands-on (bring your laptop).

### **Readings:**

Scientific papers are listed in connection with each class. Some are obligatory readings, some are offered as additional background references. Students are expected to have read the obligatory papers prior to each class.

The following can be a useful reference book for statistical notions that are relevant for the class.

Canning, J. (2013) Statistics for the Humanities (online book):

<http://www.statisticsforhumanities.net/book/wp-content/uploads/2014/07/StatisticsforHumanities%20Sept14.pdf>

### **Examination:**

Take-home assignment, optional subject, external examiner, 7-point scale, extent 4-5 standard pages.

The exam can be taken individually or as a group exam by 2-3 students but with individual assessment. For group exams, each individual participant's contribution to the assignment must be readily identifiable, and the joint part must not exceed 50% of the total work. The scope for the take-home assignment for groups is: 6-8 standard pages (2 students) or 8-10 standard pages (3 students). The resit can only be taken individually.

Resit: 6-10 standard pages, individual, set subject.

<p>I: 7/2 PP</p>	<p><i>Multimodality</i></p> <p><b>Topics</b></p> <p>General course information</p> <p>Introduction to:</p> <ul style="list-style-type: none"> <li>• Multimodal communication – terms and definitions</li> <li>• Multimodality and ICT</li> <li>• Multimodality and cognition</li> </ul>
<p>II: 14/2 PP</p>	<p><i>Multimodal data</i></p> <p><b>Topics</b></p> <ul style="list-style-type: none"> <li>• Annotating and classifying gestural behaviour.</li> <li>• Grounding textual meaning in images</li> <li>• Elements of statistics: measures of central tendency and spread.</li> </ul> <p><b>Readings</b></p> <p>Oviatt (2017) Theoretical Foundations of Multimodal Interfaces and Systems. <i>The Handbook of Multimodal-Multisensor Interfaces</i>, Volume 1, Chapter 1, pp. 19-42.  <a href="http://www.morganclypoolpublishers.com/catalog_Orig/samples/9781970001655_sample.pdf">http://www.morganclypoolpublishers.com/catalog_Orig/samples/9781970001655_sample.pdf</a></p> <p><b>The focus questions at the end of the article will be discussed in class.</b></p>
<p>III: 21/2 PP</p>	<p><i>Coordination between non-verbal behaviour and speech</i></p> <p><b>Topics</b></p> <ul style="list-style-type: none"> <li>• Cognitive theories of speech-gesture co-production, and speech-gesture synchronisation.</li> <li>• Group work based on the two papers in the reading list.</li> <li>• Elements of statistics: the t-test.</li> </ul> <p><b>Readings</b></p> <p>Giorgolo, G: and F. A. J. Verstraten (2008) Perception of 'Speech-and-Gesture' Integration. International Conference on Auditory-Visual Speech Perception 2008.  <a href="http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.572.5069&amp;rep=rep1&amp;type=pdf">http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.572.5069&amp;rep=rep1&amp;type=pdf</a></p> <p>Leonard, T. and Cummins, F. (2010) The temporal relation between beat gestures and speech. <i>Language and Cognitive Processes</i>. v. 26(10), 1457-1471.  <a href="http://cspeech.ucd.ie/Fred/docs/cumminsLeonard2010Preprint.pdf">http://cspeech.ucd.ie/Fred/docs/cumminsLeonard2010Preprint.pdf</a></p>

IV: 28/2  
PP

*Creating corpora of multimodal behaviour*

**Topics**

- Multimodal data and corpora (including language and vision corpora).
- Reliability and inter-annotator agreement.
- Elements of statistics: the chi-square test.
- Machine learning applied to multimodal corpora

**Readings**

Carletta, J. (1996). Assessing agreement on classification tasks: the kappa statistic. *arXiv preprint cmp-lg/9602004*. <https://www.aclweb.org/anthology/J96-2004.pdf>

**Background references**

Carletta et al. (2006) The AMI Corpus: A Pre-announcement. S. Renals and S. Bengio (Eds.): MLMI 2005, LNCS 3869, pp. 28–39, 2006. Springer-Verlag Berlin Heidelberg 2006.

[https://link.springer.com/content/pdf/10.1007%2F11677482\\_3.pdf](https://link.springer.com/content/pdf/10.1007%2F11677482_3.pdf)

Paggio, P., and C. Navarretta (2016) The Danish NOMCO Corpus Multimodal Interaction in First Acquaintance Conversations. *Journal of Language Resources and Evaluation*. Springer, pp.1-32.

<http://link.springer.com/article/10.1007/s10579-016-9371-6/fulltext.html>

Zadeh et al. (2018) Multimodal Language Analysis in the Wild: CMU-MOSEI Dataset and Interpretable Dynamic Fusion Graph. In *Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics*, pp. 2236–2246 Melbourne, Australia, July 15 - 20, 2018. <http://aclweb.org/anthology/P18-1208>

Bernardi, R., Cakici, R., Elliott, D., Erdem, A., Erdem, E., Ikizler-Cinbis, N., ... & Plank, B. (2016). Automatic description generation from images: A survey of models, datasets, and evaluation measures. *Journal of Artificial Intelligence Research*, 55, 409-442. <https://jair.org/index.php/jair/article/view/10985>

<p>V: 6/3 PP</p>	<p><i>Experimental studies</i></p> <p><b>Topics</b></p> <ul style="list-style-type: none"> <li>• The role of non-verbal behaviour on attention, memory, and language learning.</li> <li>• Elements of statistics: analysis of variance.</li> </ul> <p><b>Readings</b></p> <p>One of the following papers (student's choice), which will form the basis for group work in class.</p> <p>Marianne Gullberg and Sotaro Kita. Attention to Speech-Accompanying Gestures: Eye Movements and Information Uptake. <i>Journal of Non-verbal Behavior</i> (2009) 33: 251-277 Springer Verlag.  <a href="http://pubman.mpdl.mpg.de/pubman/item/escidoc:61361:11/component/escidoc:69889/gullberg_2009_attention.pdf">http://pubman.mpdl.mpg.de/pubman/item/escidoc:61361:11/component/escidoc:69889/gullberg_2009_attention.pdf</a></p> <p>Wing Chee So, Colin Sim Chen-Hui &amp; Julie Low Wei-Shan. Mnemonic effect of iconic gesture and beat gesture in adults and children: Is meaning in gesture important for memory recall? <i>Language and Cognitive Processes</i> 2011, 1-17, Psychology Press, Taylor &amp; Francis Group. Downloades gennem Kgl Bibl/Univ. Bibl. <a href="http://www.tandfonline.com/doi/abs/10.1080/01690965.2011.573220">http://www.tandfonline.com/doi/abs/10.1080/01690965.2011.573220</a></p> <p>Manuela Macedonia &amp; Katharina von Kriegstein Gestures Enhance Foreign Language Learning <i>Biolinguistics</i> 6.3-4: 393-416, 2012.  <a href="http://www.biolinguistics.eu/index.php/biolinguistics/article/view/248/269">http://www.biolinguistics.eu/index.php/biolinguistics/article/view/248/269</a></p>
<p>VI: 13/3 PP</p>	<p><i>Understanding emojis in online resources</i></p> <p><b>Topics</b></p> <ul style="list-style-type: none"> <li>• Simulating gestural expression in text: the use of emoji.</li> <li>• Elements of statistics: correlations.</li> </ul> <p><b>Readings</b></p> <p>Lu et al. (2016) Learning from the ubiquitous language: an empirical analysis of emoji usage of smartphone users. <i>Ubicomp '16</i>, Heideberg, DE, p. 770-780.  <a href="http://www.personal.umich.edu/~qmei/pub/ubicomp2016-emoji.pdf">http://www.personal.umich.edu/~qmei/pub/ubicomp2016-emoji.pdf</a></p> <p>Barbieri et al. (2016) What does this emoji mean? A vector space skip-gram model for twitter emojis. <i>Proceedings of LREC 2016</i>, p. 3967-3972.  <a href="http://sempub.taln.upf.edu/tw/emojis/Barbieri__What_does_this_emoji_mean_LR_EC2016.pdf">http://sempub.taln.upf.edu/tw/emojis/Barbieri__What_does_this_emoji_mean_LR_EC2016.pdf</a></p> <p>Giulia Donato and Patrizia Paggio (2018) Classifying the Informative Behaviour of Emoji in Microblogs. <i>Proceedings of LREC 2018</i>, pp. 679-683.  <a href="http://www.lrec-conf.org/proceedings/lrec2018/pdf/253.pdf">http://www.lrec-conf.org/proceedings/lrec2018/pdf/253.pdf</a></p>

<p>VII: 20/3 PP</p>	<p><i>Exam preparation</i></p> <p><b>Topics</b></p> <ul style="list-style-type: none"> <li>• Presentations by previous students</li> <li>• Mid-term quiz.</li> <li>• Exam preparation workshop.</li> <li>• Midterm evaluation</li> </ul>
<p>Easter vacation</p>	
<p>VIII: 3/4 CN</p>	<p><i>Motor action and cross-modal integration</i></p> <p><b>Topics</b></p> <p>Motor action and mental action, mirroring, cross-modal integration</p> <p><b>Readings</b></p> <p>Rizzolatti and Craigheri The Mirror-Neuron System <i>Annu. Rev. Neurosci.</i> 2004. 27:169–92 <a href="http://psych.colorado.edu/~kimlab/Rizzolatti.annurev.neuro.2004.pdf">http://psych.colorado.edu/~kimlab/Rizzolatti.annurev.neuro.2004.pdf</a></p> <p>Lorraine E. Bahrick and Robert Lickliter Learning to Attend Selectively: The Dual Role of Intersensory Redundancy, <i>Current Directions in Psychological Science</i>, 2014, Vol. 23(6) 414–420 <a href="http://journals.sagepub.com/doi/pdf/10.1177/096372141454918">http://journals.sagepub.com/doi/pdf/10.1177/096372141454918</a></p>
<p>IX: 10/4 CN</p>	<p><i>An introduction to Emotions</i></p> <p><b>Topics</b></p> <p>Emotions and Cognition (learning, memory, attention, social behaviour); Emotion classification systems</p> <p><b>Readings</b></p> <p><i>Obligatory</i></p> <p>Ekman, P. (1992). An Argument for Basic Emotions. <i>Cognition and Emotion</i>, 1992, 6 (3/4) 169-200. <a href="https://www.paulekman.com/wp-content/uploads/2013/07/An-Argument-For-Basic-Emotions.pdf">https://www.paulekman.com/wp-content/uploads/2013/07/An-Argument-For-Basic-Emotions.pdf</a></p> <p>Tyng CM, Amin HU, Saad MNM, Malik AS. The Influences of Emotion on Learning and Memory. <i>Front Psychol.</i> 2017 Aug 24;8:1454. doi: 10.3389/fpsyg.2017.01454. PMID: 28883804; PMCID: PMC5573739. <a href="https://www.frontiersin.org/articles/10.3389/fpsyg.2017.01454/full?fbclid=IwAR1X0KywrVcqD9WOb8KYMIUjlnKMXRpAwMKUNtEnQoKwxsSFbrzbBzs2tpc">https://www.frontiersin.org/articles/10.3389/fpsyg.2017.01454/full?fbclid=IwAR1X0KywrVcqD9WOb8KYMIUjlnKMXRpAwMKUNtEnQoKwxsSFbrzbBzs2tpc</a></p> <p><b>Topic matching: Topic interest – individual/group</b></p> <p><b>Hands on</b></p>

<p>X: 17/4 CN</p>	<p><i>Processing emotions</i></p> <p><b>Topics</b> Affective computing; Emotion identification; Emotion databases; Face identification – cognitive aspects</p> <p><b>Readings</b> <i>Obligatory</i> Michael Kipp and Jean-Claude Martin. Gesture and Emotion: Can basic gestural form features discriminate emotions? In: <i>Int. Conf. on Affective Computing and Intelligent Interaction</i>. IEEE Press, 2009. <a href="http://www.limsi.fr/Individu/martin/papers/KippMartin09.pdf">http://www.limsi.fr/Individu/martin/papers/KippMartin09.pdf</a></p> <p>Patrik N. Juslin 2013. What does music express? Basic emotions and beyond. <i>Frontiers in Psychology</i>. Vol.4 <a href="https://doi.org/10.3389/fpsyg.2013.00596">https://doi.org/10.3389/fpsyg.2013.00596</a></p> <p>Marechal C. et al. (2019) Survey on AI-Based Multimodal Methods for Emotion Detection. In: Kołodziej J., González-Vélez H. (eds) <i>High-Performance Modelling and Simulation for Big Data Applications</i>. Lecture Notes in Computer Science, vol 11400. Springer, Cham , pp. 307-324 <a href="https://link.springer.com/content/pdf/10.1007%2F978-3-030-16272-6_11.pdf">https://link.springer.com/content/pdf/10.1007%2F978-3-030-16272-6_11.pdf</a></p> <p><b>Hands on</b> <b>Student presentations: Data that you want to work with/and group formations</b></p>
<p>Date to be announced</p>	<p><b><i>Deadline for filling in spreadsheet with individual or group exam (and group members).</i></b></p> <p>Link to document to be added</p>
<p>XI: 24/04 CN</p>	<p><i>Personality and personality computing</i></p> <p><b>Topics</b> Personality and Cognition; Personality computing; Datasets</p> <p><b>Readings</b> <i>Obligatory</i> Phan, L. V., &amp; Rauthmann, J. F. (2021). Personality computing: New frontiers in personality assessment. <i>Social and Personality Psychology Compass</i>, 15( 7). <a href="https://onlinelibrary.wiley.com/doi/full/10.1111/spc3.12624">https://onlinelibrary.wiley.com/doi/full/10.1111/spc3.12624</a></p> <p>Yash Mehta, Navonil Majumder, Alexander Gelbukh, Erik Cambria (2020) Recent trends in deep learning based personality detection <i>Artificial Intelligence Review</i> 53:2313–2339 <a href="https://sentic.net/personality-detection.pdf">https://sentic.net/personality-detection.pdf</a></p> <p><i>Additional readings</i></p>

	<p>Bhavya S., Pillai A.S., Guazzaroni G. (2020) Personality Identification from Social Media Using Deep Learning: A Review. In: Das K., Bansal J., Deep K., Nagar A., Pathipooranam P., Naidu R. (eds) <i>Soft Computing for Problem Solving. Advances in Intelligent Systems and Computing</i>, vol 1057. Springer, Singapore (on-line 2019) <a href="https://link.springer.com/chapter/10.1007/978-981-15-0184-5_45">https://link.springer.com/chapter/10.1007/978-981-15-0184-5_45</a></p> <p><b>Hands on</b> <b>Questions about topics</b></p>
Date to be announced	<b><i>Deadline for assignment upload: exam project description</i></b>
XII:1/5	<p><i>Gesture recognition</i></p> <p><b>Topics</b> Automatic gesture identification, Research ethics</p> <p><b>Readings</b> <i>Obligatory</i> Bhaumik, G., Verma, M., Govil, M.C. et al. HyFiNet: Hybrid feature attention network for hand gesture recognition. <i>Multimed Tools Appl</i> (2022). <a href="https://doi.org/10.1007/s11042-021-11623-3">https://doi.org/10.1007/s11042-021-11623-3</a> Canal, Felipe Zago, et al. "A survey on facial emotion recognition techniques: A state-of-the-art literature review." <i>Information Sciences</i> 582 (2022): 593-617. <a href="https://www.sciencedirect.com/science/article/pii/S0020025521010136">https://www.sciencedirect.com/science/article/pii/S0020025521010136</a></p>
<p>XIII-XIV: 8/5 time and class to be announced</p> <p>CN</p>	<p><b><i>Exam Workshop</i></b></p> <p><b>Presentation and discussion of exam projects.</b></p>