REFERENCES

[1] "World population ageing 2015," ST/ESA/SER.A/390, Population Division, Department of Economic and Social Affairs, United Nations, 2015.

[2] D. O. Johnson, R. H. Cuijpers, J. F. Juola, E. Torta, M. Simonov, A. Frisiello, M. Bazzani, W. Yan, C. Weber, S. Wermter, *et al.*, "Socially assistive robots: a comprehensive approach to extending independent living," *International journal of social robotics*, vol. 6, no. 2, pp. 195–211, 2014.

[3] E. Broadbent, R. Stafford, and B. MacDonald, "Acceptance of healthcare robots for the older population: review and future directions," *International Journal of Social Robotics*, vol. 1, no. 4, p. 319, 2009.

[4] D. Feil-Seifer and M. J. Matarić, "Socially assistive robotics," *IEEE Robotics & Automation Magazine*, vol. 18, no. 1, pp. 24–31, 2011.

[5] N. Mavridis, "A review of verbal and non-verbal human–robot interactive communication," *Robotics and Autonomous Systems*, vol. 63, pp. 22–35, 2015.

[6] T. Haidegger, M. Barreto, P. Gonçalves, M. K. Habib, S. K. V. Ragavan, H. Li, A. Vaccarella, R. Perrone, and E. Prestes, "Applied ontologies and standards for service robots," *Robotics and Autonomous Systems*, vol. 61, no. 11, pp. 1215–1223, 2013.

[7] H. Takeda, N. Kobayashi, Y. Matsubara, and T. Nishida, "Towards ubiquitous human-robot interaction," in *Working Notes for IJCAI-97 Workshop on Intelligent Multimodal Systems*, pp. 1–8, 1997.

[8] T. Darrell and A. Pentland, "Space-time gestures," in *Computer Vision and Pattern Recognition, 1993. Proceedings CVPR'93., 1993 IEEE Computer Society Conference on*, pp. 335–340, IEEE, 1993.

[9] E. Prassler, G. Lawitzky, A. Stopp, G. Grunwald, M. Hägele, R. Dillmann, and I. Iossifidis, *Advances in Human-Robot Interaction*, vol. 14. Springer Science & Business Media, 2004.

[10] Z. Obrenovic and D. Starcevic, "Modeling multimodal human-computer interaction," *Computer*, vol. 37, no. 9, pp. 65–72, 2004.

[11] N. Roy, G. Baltus, D. Fox, F. Gemperle, J. Goetz, T. Hirsch, D. Margaritis, M. Montemerlo, J. Pineau, J. Schulte, *et al.*, "Towards personal service robots for the elderly," in *Workshop on Interactive Robots and Entertainment (WIRE 2000)*, vol. 25, p. 184, 2000.

[12] C. L. Sidner and C. Lee, "Engagement rules for human-robot collaborative interactions," in *Systems, Man and Cybernetics, 2003. IEEE International Conference on*, vol. 4, pp. 3957–3962, IEEE, 2003.

[13] P. Ekman, "An argument for basic emotions," *Cognition & emotion*, vol. 6, no. 3-4, pp. 169–200, 1992.

[14] R. Plutchik, "The nature of emotions human emotions have deep evolutionary roots, a fact that may explain their complexity and provide tools for clinical practice," *American scientist*, vol. 89, no. 4, pp. 344–350, 2001.

[15] J. A. Russell and A. Mehrabian, "Evidence for a three-factor theory of emotions," *Journal of research in Personality*, vol. 11, no. 3, pp. 273–294, 1977.

[16] J. A. Russell, "Core affect and the psychological construction of emotion.," *Psychological review*, vol. 110, no. 1, p. 145, 2003.

[17] H. Lövheim, "A new three-dimensional model for emotions and monoamine neurotransmitters," *Medical hypotheses*, vol. 78, no. 2, pp. 341–348, 2012.

[18] M. D. Munezero, C. S. Montero, E. Sutinen, and J. Pajunen, "Are they different? affect, feeling, emotion, sentiment, and opinion detection in text," *IEEE transactions on affective computing*, vol. 5, no. 2, pp. 101–111, 2014.

[19] E. Shouse, "Feeling, emotion, affect," *M/c journal*, vol. 8, no. 6, p. 26, 2005.

[20] P. A. Thoits, "The sociology of emotions," *Annual review of sociology*, vol. 15, no. 1, pp. 317–342, 1989.

[21] R. J. Dolan, "Emotion, cognition, and behavior," *science*, vol. 298, no. 5596, pp. 1191–1194, 2002.

[22] R. Plutchik, "The nature of emotions human emotions have deep evolutionary roots, a fact that may explain their complexity and provide tools for clinical practice," *American scientist*, vol. 89, no. 4, pp. 344–350, 2001.

[23] R. A. Calvo and S. D'Mello, "Affect detection: An interdisciplinary review of models, methods, and their applications," *IEEE Transactions on affective computing*, vol. 1, no. 1, pp. 18–37, 2010.

[24] P. Ekman, "An argument for basic emotions," *Cognition & emotion*, vol. 6, no. 3-4, pp. 169–200, 1992.

[25] A. Kleinsmith and N. Bianchi-Berthouze, "Affective body expression perception and recognition: A survey," *IEEE Transactions on Affective Computing*, vol. 4, no. 1, pp. 15–33, 2013.

[26] R. Khosrowabadi, H. C. Quek, A. Wahab, and K. K. Ang, "Eeg-based emotion recognition using self-organizing map for boundary detection," in *Pattern Recognition (ICPR), 2010 20th International Conference on*, pp. 4242–4245, IEEE, 2010.

[27] M. El Ayadi, M. S. Kamel, and F. Karray, "Survey on speech emotion recognition: Features, classification schemes, and databases," *Pattern Recognition*, vol. 44, no. 3, pp. 572–587, 2011.

[28] J. A. Russell, J.-A. Bachorowski, and J.-M. Fernández-Dols, "Facial and vocal expressions of emotion," *Annual review of psychology*, vol. 54, no. 1, pp. 329–349, 2003.

[29] R. Cowie, E. Douglas-Cowie, N. Tsapatsoulis, G. Votsis, S. Kollias, W. Fellenz, and J. G. Taylor, "Emotion recognition in human-computer interaction," *IEEE Signal processing magazine*, vol. 18, no. 1, pp. 32–80, 2001.

[30] R. Cowie and E. Douglas-Cowie, "Automatic statistical analysis of the signal and prosodic signs of emotion in speech," in *Spoken Language, 1996. ICSLP 96. Proceedings., Fourth International Conference on*, vol. 3, pp. 1989–1992, IEEE, 1996.

[31] Y. Li, L. Chao, Y. Liu, W. Bao, and J. Tao, "From simulated speech to natural speech, what are the robust features for emotion recognition?," in *Affective Computing and Intelligent Interaction (ACII), 2015 International Conference on*, pp. 368–373, IEEE, 2015.

[32] J. Nicholson, K. Takahashi, and R. Nakatsu, "Emotion recognition in speech using neural networks," *Neural computing & applications*, vol. 9, no. 4, pp. 290–296, 2000.

[33] A. Austermann, N. Esau, L. Kleinjohann, and B. Kleinjohann, "Fuzzy emotion recognition in natural speech dialogue," in *Robot and Human Interactive Communication, 2005. ROMAN 2005. IEEE International Workshop on*, pp. 317–322, IEEE, 2005.

[34] A. A. Razak, R. Komiya, M. Izani, and Z. Abidin, "Comparison between fuzzy and nn method for speech emotion recognition," in *Information Technology and Applications, 2005. ICITA 2005. Third International Conference on*, vol. 1, pp. 297–302, IEEE, 2005.

[35] R. Tokuhisa, K. Inui, and Y. Matsumoto, "Emotion classification using massive examples extracted from the web," in *Proceedings of the 22nd Inter-*

national Conference on Computational Linguistics-Volume 1, pp. 881–888, Association for Computational Linguistics, 2008.

[36] B. Schuller, G. Rigoll, and M. Lang, "Speech emotion recognition combining acoustic features and linguistic information in a hybrid support vector machine-belief network architecture," in *Acoustics, Speech, and Signal Processing, 2004. Proceedings.(ICASSP'04). IEEE International Conference on*, vol. 1, pp. I–577, IEEE, 2004.

[37] B. Schuller, M. Lang, and G. Rigoll, "Robust acoustic speech emotion recognition by ensembles of classifiers," *Fortschritte der Akustik*, vol. 31, no. 1, p. 329, 2005.

[38] C. Breazeal, "Emotion and sociable humanoid robots," *International Journal of Human-Computer Studies*, vol. 59, no. 1, pp. 119–155, 2003.

[39] Z. Zeng, M. Pantic, G. I. Roisman, and T. S. Huang, "A survey of affect recognition methods: Audio, visual, and spontaneous expressions," *IEEE transactions on pattern analysis and machine intelligence*, vol. 31, no. 1, pp. 39–58, 2009.

[40] Y.-L. Tian, T. Kanade, and J. F. Cohn, "Facial expression analysis," *Handbook of face recognition*, pp. 247–275, 2005.

[41] C. E. Osgood, W. H. May, and M. S. Miron, *Cross-cultural universals of affective meaning*, vol. 1. University of Illinois Press, 1975.

[42] C. E. Osgood and O. Tzeng, *Language, meaning, and culture: The selected papers of CE Osgood*. Praeger Publishers, 1990.

[43] J. T. Hancock, C. Landrigan, and C. Silver, "Expressing emotion in text-based communication," in *Proceedings of the SIGCHI conference on Human factors in computing systems*, pp. 929–932, ACM, 2007.

[44] J. Wagner, E. Andre, F. Lingenfelser, and J. Kim, "Exploring fusion methods for multimodal emotion recognition with missing data," *IEEE Transactions on Affective Computing*, vol. 2, no. 4, pp. 206–218, 2011.

[45] M. Pantic and L. J. Rothkrantz, "Toward an affect-sensitive multimodal human-computer interaction," *Proceedings of the IEEE*, vol. 91, no. 9, pp. 1370–1390, 2003.

[46] J. Bhaskar, K. Sruthi, and P. Nedungadi, "Hybrid approach for emotion classification of audio conversation based on text and speech mining," *Procedia Computer Science*, vol. 46, pp. 635–643, 2015.

[47] C. Busso, Z. Deng, S. Yildirim, M. Bulut, C. M. Lee, A. Kazemzadeh, S. Lee, U. Neumann, and S. Narayanan, "Analysis of emotion recognition using facial expressions, speech and multimodal information," in *Proceedings of the 6th international conference on Multimodal interfaces*, pp. 205–211, ACM, 2004.

[48] J. Weizenbaum, "Elizaa computer program for the study of natural language communication between man and machine," *Communications of the ACM*, vol. 9, no. 1, pp. 36–45, 1966.

[49] K. M. Colby, "Modeling a paranoid mind," *Behavioral and Brain Sciences*, vol. 4, no. 4, pp. 515–534, 1981.

[50] I. V. Serban, A. Sordoni, Y. Bengio, A. C. Courville, and J. Pineau, "Hierarchical neural network generative models for movie dialogues," *CoRR*, *abs/1507.04808*, 2015.

[51] T. Kanda, M. Shiomi, Z. Miyashita, H. Ishiguro, and N. Hagita, "A communication robot in a shopping mall," *IEEE Transactions on Robotics*, vol. 26, no. 5, pp. 897–913, 2010.

[52] H. Wang, F. Zhang, X. Fan, and X. Lu, "A practical service robot system for greeting guests," in *Control Conference (CCC), 2012 31st Chinese*, pp. 4997–5001, IEEE, 2012.

[53] D. Bohus, C. W. Saw, and E. Horvitz, "Directions robot: in-the-wild experiences and lessons learned," in *Proceedings of the 2014 international conference on Autonomous agents and multi-agent systems*, pp. 637–644, International Foundation for Autonomous Agents and Multiagent Systems, 2014.

[54] D. Jurafsky, "Speech and language processing: An introduction to natural language processing," *Computational linguistics, and speech recognition*, 2000.

[55] J. Cassell, "Embodied conversational interface agents," *Communications of the ACM*, vol. 43, no. 4, pp. 70–78, 2000.

[56] J. R. Wilson, "Towards an affective robot capable of being a long-term companion," in *Affective Computing and Intelligent Interaction (ACII), 2015 International Conference on*, pp. 754–759, IEEE, 2015.

[57] T. Giannakopoulos, "pyaudioanalysis: An open-source python library for audio signal analysis," *PloS one*, vol. 10, no. 12, 2015.

[58] S. Haq and P. J. Jackson, "Multimodal emotion recognition," *Machine audition: principles, algorithms and systems*, pp. 398–423, 2010.

[59] F. Burkhardt, A. Paeschke, M. Rolfes, W. F. Sendlmeier, and B. Weiss, "A database of german emotional speech.," in *Interspeech*, vol. 5, pp. 1517–1520, 2005.

[60] R. M. Agrigoroaie and A. Tapus, "Developing a healthcare robot with personalized behaviors and social skills for the elderly," in *The Eleventh ACM/IEEE International Conference on Human Robot Interaction*, pp. 589–590, IEEE Press, 2016.

[61] R. V. Ibanez, M. U. Keysermann, and P. A. Vargas, "Emotional memories in autonomous robots," in *Robot and Human Interactive Communication, 2014 RO-MAN: The 23rd IEEE International Symposium on*, pp. 405–410, IEEE, 2014.

[62] E. A. Kensinger, "Negative emotion enhances memory accuracy: Behavioral and neuroimaging evidence," *Current Directions in Psychological Science*, vol. 16, no. 4, pp. 213–218, 2007.

[63] C. Kuhbandner and R. Pekrun, "Joint effects of emotion and color on memory.," *Emotion*, vol. 13, no. 3, p. 375, 2013.

[64] M. A. V. J. Muthugala and A. G. B. P. Jayasekara, "Mirob: An intelligent service robot that learns from interactive discussions while handling uncertain information in user instructions," in *Moratuwa Engineering Research Conference (MERCon), 2016*, pp. 397–402, IEEE, 2016.