



UNIVERSITÀ DEGLI STUDI DI PADOVA

Study the influence of age and gender in social human-robot interaction

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Co-supervisor: Gloria Beraldo





Education

Carros, Felix, Isabel Schwaninger, Adrian Preussner, Dave Randall, Rainer Wieching, Geraldine Fitzpatrick, and Volker Wulf. 'Care Workers Making Use of Robots: Results of a Three-Month Study on Human-Robot Interaction within a Care Home'. In *CHI Conference on Human Factors in Computing Systems*, 1–15. New Orleans LA USA: ACM, 2022. <https://doi.org/10.1145/3491102.3517435>.



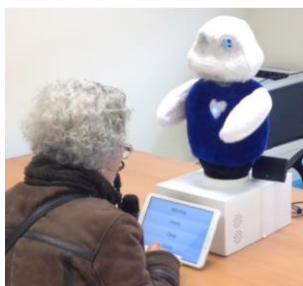
Disease management
(e.g.,
dementia,
autism)



Wood, Luke J., Abolfazl Zaraki, Ben Robins, and Kerstin Dautenhahn. 'Developing Kaspar: A Humanoid Robot for Children with Autism'. *International Journal of Social Robotics* 13, no. 3 (June 2021): 491–508. <https://doi.org/10.1007/s12369-019-00563-6>.

Social
Robot

Support
elderly and
patients



Beraldo, Gloria, Emanuele Menegatti, Valentina de Tommasi, Roberto Mancin, and Franca Benini. 'A Preliminary Investigation of Using Humanoid Social Robots as Non-Pharmacological Techniques with Children'. In *2019 IEEE International Conference on Advanced Robotics and Its Social Impacts (ARSO)*, 393–400, 2019. <https://doi.org/10.1109/ARSO46408.2019.8948760>.

Papazoglou, Theodora, Charalampos Karagiannidis, and Sofia Mavropoulou. 'Educational Robotics Can Foster Social Inclusion and Social Status of Children with Autism'. In *2021 International Conference on Advanced Learning Technologies (ICALT)*, 317–19, 2021. <https://doi.org/10.1109/ICALT52272.2021.00102>.

Salichs, Miguel A., Álvaro Castro-González, Esther Salichs, Enrique Fernández-Rodicio, Marcos Maroto-Gómez, Juan José Gamboa-Montero, Sara Marques-Villarroya, José Carlos Castillo, Fernando Alonso-Martín, and Maria Malfaz. 'Mini: A New Social Robot for the Elderly'. *International Journal of Social Robotics* 12, no. 6 (December 2020): 1231–49. <https://doi.org/10.1007/s12369-020-00687-0>.



Define the user through:

- Name, surname
- **Gender**
- **Age**
- (Pose)



- It is crucial to define an appropriate age range in the classification: “The study has shown that the overall accuracy tends to degrade with the introduction of more classes.”[1]
- Accuracy is closely related to the database on which the models have been trained.
- Few studies using age estimation with social robots.



Age estimation in human-robot interaction is still a challenging task.

1. ELKarazle, Khaled, Valliappan Raman, and Patrick Then. ‘Facial Age Estimation Using Machine Learning Techniques: An Overview’. *Big Data and Cognitive Computing* 6, no. 4 (December 2022): 128. <https://doi.org/10.3390/bdcc6040128>.
2. Hassan, Bilal, Ebroul Izquierdo, and Tomas Piatrik. ‘Soft Biometrics: A Survey’. *Multimedia Tools and Applications*, 2 March 2021. <https://doi.org/10.1007/s11042-021-10622-8>.



Dataset	Number of Samples	Age Group	Gender Label
IMDB-WIKI	523,051	1-90	Yes
Cross-age Celebrity Dataset (CACD)	163,446	16-62	No
MORPH	55,134	16-77	No
MegaAge	41,941	0-70	No
Adience	26,580	0-60	Yes
UTKFace	23,000	0-116	Yes
FGNET	1002	0-69	No
MSU LFW+	15,699	0-20	Yes



Year	Research	Methods	Dataset	Performance
2022	Sharma et al., 'Face-Based Age and Gender Estimation Using Improved Convolutional Neural Network Approach'.	CNN	UTKFace IMDB-WIKI FG-NET CACD	MAE=0.77y and accuracy=94.01% MAE=2.9y MAE=3.9y MAE=7.4y
2021	Greco et al., 'Effective Training of Convolutional Neural Networks for Age Estimation Based on Knowledge Distillation'.	VGG, SENet, DenseNet and MobileNet	LFW+ LAP 2016 Adience	LFW+ with SENet and VGG MAE=5.58y LAP with SENet epsilon-error=0.3033 Adience with SENet top-1=65.0%, 1-off=97.1%
2019	Carolus, Macchiarulo, and Palestra, 'Soft Biometrics for Social Adaptive Robots'.	CNN	IMDB-WIKI	62.50% on 32 participants



Year	Research	Methods	Dataset	Performance
2022	Sharma et al., 'Face-Based Age and Gender Estimation Using Improved Convolutional Neural Network Approach'.	CNN	UTKFace	Accuracy=99.86%
2021	Althnian et al., 'Face Gender Recognition in the Wild'.	SVM, CNN	Adience, LFW	Accuracy from 55% to 91% depending on the used model and dataset
2019	Carolis, Macchiarulo, and Palestra, 'Soft Biometrics for Social Adaptive Robots'.	CNN	IMDB-WIKI	87.50% on 32 participants

[3] explains a multi-task model that starts with face detection and combines gender, emotion, age and ethnicity estimation.

<i>Multi-task versus single task accuracy</i>	
Improving	Worsening
on gender (about 0.1%) and emotions (1.5%–2%)	on age (about 0.5 years) and ethnicity (about 0.5%)

Research question: Evaluating the influence of gender and age in the social-human robot interaction.

Technical contribution: Estimate age (and gender) from detected face.

Methods: Pepper proposes and executes the following tasks based on age and gender:

TABLE I: Stereotypically male, female and neutral tasks, used in this study.

Gender	Stereotypically Task
Male	Transporting goods Guarding house Explaining how a tool works, for instance a Hoover Supporting a soccer team
Female	Telling a tale to a child Reading a book in a loud voice Mopping floors Preparing meals Dancing
Neutral	Greeting a human being and introducing itself Shooting a human being Telling a joke or asking riddle

Beraldo Gloria, Silvia Di Battista, Silvana Badaloni, Emanuele Menegatti, and Monica Pivetti. 'Sex Differences in Expectations and Perception of a Social Robot'. In *2018 IEEE Workshop on Advanced Robotics and Its Social Impacts (ARSO)*, 38–43, 2018.

<https://doi.org/10.1109/ARSO.2018.8625826>.



- ✓ Studied the literature
- ✓ Executed some basic tutorials with Choreographe
- ☐ Choosing some appropriate datasets to start the implementation