



DAVID HANSON, PH.D.  
184-186 Texaco Road, room 9 C  
Tsuen Wan, New Territories, HK  
+852-5149-0926, david@hansonrobotics.com

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Re: Jakub Šura

### **LETTER OF RECOMMENDATION**

Dear Colleagues at the Czech Technical University,

It is with great pleasure that I write this letter evaluating Jakub Šura's impressive master's thesis, titled "Sophia the Robot - Development of a Software Extension - Detection and Reaction to Being Photographed by a Phone Camera." As Jakub's thesis supervisor, I have had the privilege of closely collaborating with him on this groundbreaking research over the past year. In a nutshell, Jakub's work represents an exceptional advancement in social robotics and multimodal AI interaction, significantly enhancing Sophia's capabilities in an innovative and technically sophisticated manner. I give this paper an A+, on an A-F scale.

As the founder, CTO, and CEO of Hanson Robotics, I have personally mentored and collaborated with Jakub in his work, and can attest to his excellence, innovation, and leadership skills in everything that he does. For the past 14 months, Jakub worked with our team at Hanson Robotics, helping to operate robots at events, engineer our software, and create interactions with our robotic character, and in this position, he helped to advance our novel soft robotics approach to improve the social expressions of our robots for human-AI relations, in particular advancing our work with Sophia the Robot, an advanced human-like robot developed by me and Hanson Robotics, all the while developing and integrating his master's research with his work on our SDK and robots.

In his duties, Jakub directly worked with me and my lead engineers at Hanson Robotics to develop and test cutting-edge research controls, perceptual algorithms, and other aspects of our robotics and human robot interactions. He has contributed significantly to our research efforts by coding the entire application, co-developing various aspects of the perceptual, attention, and motion control stack expressions, testing the results, and contributing future ideas to our company. During discussions, he proved capable in bringing unique perspectives to conversation, demonstrating leadership skills, and overcoming hurdles with an avid growth mindset. Throughout this work, Jakub strove to address the theoretical and

practical challenges described in his master's thesis. I was honored to work with Jakub in this capacity of advisor and mentor, and am pleased to see the culmination of this work in his excellent master's thesis.

In his thesis, Jakub's research addresses a fundamental challenge in human-robot interaction - enabling robots to detect, interpret, and respond to naturalistic social cues in unstructured environments. The ability for a robot like Sophia to recognize when she is being photographed and to react with contextually appropriate behaviors like smiling, posing, or verbally acknowledging the camera, is crucial for her to come across as socially aware and engaging. This is no easy feat, requiring the seamless integration of computer vision, spoken language understanding, reasoning, and behavior generation.

The technical strengths of Jakub's work are numerous. He has leveraged cutting-edge machine learning approaches like zero-shot object detection and pose estimation to robustly perceive picture-taking scenarios. The attention system he designed is remarkably flexible and context-sensitive, allowing the robot to intelligently allocate its focus based on a variety of perceptual and cognitive factors. Jakub's novel behavior module produces impressively smooth, human-like responses. And by grounding the implementation in the Robot Operating System (ROS), he has ensured the work can generalize to other robots beyond Sophia.

At the same time, Jakub was rigorous in stress-testing the system and assessing its limitations. He conducted extensive real-world experiments involving multi-person interactions, gathered both quantitative metrics and qualitative user feedback, and used the insights to iteratively refine the technology. The thesis provides an honest discussion of remaining challenges, such as handling occlusions and background noise.

In my assessment, this work unequivocally meets and exceeds the high bar for a master's thesis. It tackles a problem of real intellectual merit and practical importance. The technical approach, while ambitious, is executed with skill and attention to detail. And the results speak for themselves - Sophia's Photogenic Behavior is a delightful experience that brings us one step closer to truly natural human-robot interaction.

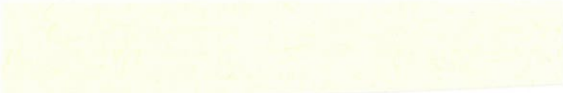
Looking ahead, I see numerous exciting avenues to build on Jakub's contributions. Incorporating additional interaction modalities like touch and emotion recognition could enable even richer behavioral responses. Leveraging continual learning to automatically refine the robot's social skills over time is another promising direction. Longer-term, the framework Jakub developed could serve as a foundation for robots to socially engage in an open-ended variety of contexts - as tutors, companions, collaborators, and beyond.

In conclusion, I believe this thesis is a shining exemplar of the caliber of work we aspire to cultivate in the field of robotics. I unequivocally support Jakub for the receipt of his master's degree with the highest distinction. He has been an absolute pleasure to advise, and I have every confidence he will continue to advance the state-of-the-art in social robotics and multimodal AI as he progresses in his career. I give his thesis an A+, on an A-F scale.

Based on the above considerations, I strongly recommend Jakub Sura for receiving his master's degree, based on his strong thesis and its evidence of strong research results,

problem-solving skills, hardworking character, and most importantly, the demonstration of his potential to truly create an impact on the world. His graduation from your program will allow him to continue this journey of self-growth and solving important problems in the world as an outstanding member of the engineering community.

Respectfully,



David Hanson, Ph.D.  
CEO, CTO, Founder of Hanson Robotics Ltd,  
Adj. Professor at the University of Southern California  
Director of the Initiative for Awakening Machines (IAM)  
*"Father of Sophia"*