Development and Assessment of an AI-Based Temperature Model of an Exemplary ICE

Relevance to the Automotive and Autonomous Systems Industries:	Thermal system and thermal management research are important topics for powertrains of the future. Simulative investigations play an increasingly important role due to their time and cost savings during the early project stages. For the project described below, the warmup of an exemplary internal combustion engine (ICE) will be modelled using various machine learning methods. These methods will then be assessed for modelling the warmup of essential powertrain components.
Research Location:	Technische Universität Darmstadt Institute for Internal Combustion Engines and Powertrain Systems (VKM)
Homepage (Engl.):	http://www.vkm.tu-darmstadt.de
Faculty Mentor:	Prof. Dr. techn. Christian Beidl
Faculty Mentor Email:	beidl@vkm.tu-darmstadt.de
Graduate Mentors:	Alexander Kuznik, M.Sc. Daniel Schade, M.Sc.
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Project Description: May 22 - Jul 28, 2023 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Internal Combustion Engines and Powertrain Systems (VKM) is concerned with the thermal systems and the related thermal management of future powertrains. Of particular interest is the ability to predict the heat flows of certain components of the powertrain. For that reason, a simulation model based on machine learning methods is being developed to simulate the temperatures of thermal inertias in relation to defined input quantities. This simulation model will be developed for an exemplary ICE and be compared with existing 0D model approaches. **PHASE A** (2 weeks): During this introductory phase, the NSF REU student will review relevant research; investigate software, toolboxes, and data; and identify relevant model input and output parameters. **PHASE B** (3 weeks): Next, the student will develop and implement different model approaches, and identify and prepare training and testing data. **PHASE C** (3 weeks): Then the student will train and test the models that have been developed, including validating these simulation results, and comparing them to those from existing modelling approaches at VKM. **PHASE D** (2 weeks): Finally, the NSF REU student will document the research performed, prepare a written report, and deliver an end-of-summer presentation on the research performed.
Target publications:	• International Symposium on Development Methodology
Necessary Skills/ Knowledge:	• Basic understanding of internal combustion engines • Interest in powertrain systems • Interest in data processing and simulation
Desirable Skills/ Knowledge:	• Basic experience with MATLAB • Basic understanding of AI and machine learning methods
Additional Online Resource(s):	

NSF REU Students must have completed at least two semesters of engineering studies prior to the proposed summer research, and they must have at least one semester remaining before they can earn their BS in Engineering.