Changlong Li

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Education

School of Mechanical Engineering, Beijing Institute of Technology   Sep. 2018 – Jul. 2021

✦ MS candidate (senior) in Mechanical Engineering. GPA: 3.27/4.0

✦ Research Direction: Deep learning, Multi-modal ground terrain identification.

School of Mechanical and Automotive Engineering, Hunan University   Sep. 2014 – Jul. 2018

✦ B.E. in Engineering Mechanics. Major GPA: 3.47/4.0

✦ Research Direction: Coupled thermo-mechanical analysis, CAD/CAE, Industrial design.

English Proficiency

✦ TOEFL(26/10/2019): 102 (Reading 30, Listening 28, Speaking 21, Writing 23)

Research Experience

School of Mechanical and Automotive Engineering, Hunan University.   Dec. 2017 – Jun. 2018

Coupled Thermo-Mechanical Analysis and Improvement of Marble-Disk Brake Mechanism

Individual Research, Advisor: Yiru Ren, Associate Professor

✦ Used Finite Element Analysis to theoretically study the static behavior of the marble-disk brake mechanism under high pressure and temperature.

✦ Used CAD tool (UGNX) to build up an accurate geometric model of the mechanism and CAE tool (ANSYS) to simulate the dynamic behavior under high pressure/temperature working state.

✦ Revealed the radius gradient field of stress/strain on the loading disk and the severe contact deviation between marbles and loading disk under high temperature working states.

✦ Redesigned the loading disk with sloped shape to adapt the gradient stress field. Replaced the spherical design of marbles with an elliptic design to increase axial contact area and to reduce contact deviation.

School of Mechanical Engineering, Beijing Institute of Technology.   Sep. 2018 – Present

Multi-modal Ground Terrain Identification for Off-road Autonomous Vehicles

Individual Research, Advisor: Sizhong Chen, Professor

✦ Built an experimental vehicle based on Nvdia Jetson TX2. Using ROS to collect a database of temporally synchronized sensor-image samples of multiple ground terrains

✦ Designed a neural network based on temporal models (RNNs, Transformers) to classify "tactile" (sensor) data of different ground terrains. Test results on our dataset reported 96.8% accuracy.

✦ Designed a texture recognition model based on deep convolutional networks to classify "visual" (image) data. Test results on the public dataset (GTOS-mobile) reported a 14.8% increase in accuracy compared to the dataset's baseline.

✦ Proposed a learnable fusion mechanism to adaptively fuse classification results of two modal. (e.g. The system will rely more on "tactile" when lighting conditions are undesirable for vision)

Optimized Handling Stability Control Strategy for the In-wheel Motor Electric vehicle

Cooperative Research, Advisor: Sizhong Chen, Professor

✦ Responsible for the simulation of the instability control mode of the lateral stability controller.

✦ Instability is detected when vehicle states (sideslip angle and yaw rate) exceeds the parallelogram envelop region of stability.

✦ Sliding mode control is used to simultaneously control two state variables under instability.

✦ Simulation experiments under critical conditions were performed based on Carsim and

MATLAB/Simulink.

State-of-Charge (SOC) Estimation of Battery based on Auto-regressive Long Short-Term Memory Network (ARLSTM) and Moving Horizon Estimation (MHE)

Cooperative Research, Advisor: Hongbin Ren, Assistant Professor; Sizhong Chen, Professor

✦ Trained an ARLSTM network offline with standard datasets to predict the SOC value from measured voltage, current values, and historical predicted SOC values.

✦ Used the MHE method to numerically optimize a cost function in which the predicted SOC serves as the reference value. State functions of the battery model are included in the MHE and the MHE directly outputs finetuned SOC estimations.

✦ The ARLSTM network contributes to the pattern adaptivity of different working conditions while MHE contribute to the accurate calculation of SOC based on present battery model.

✦ The proposed method demonstrates robustness to uncertain initial values of SOC because both ARLSTM and MHE possess the ability to learn from historical inputs. Evaluation on test data reported Mean Squared Error of 0.16.

Ping An Technology (Shenzhen) Co., Ltd. (Internship)   Oct. 2019 – Apr. 2020

Individual Research, Advisor: Wenqi Wei, Senior Algorithm Engineer

Realistic Talking Faces Synthesis from Speaker's Voice.

✦ Proposed a novel task of talking-face video generation leveraging only speaker's speech.

✦ Proposed a cross-modal dictionary learning method to capture speaker identity in voices by building connections between speaker's voices and facial images.

✦ Designed a video generation model based on Generative adversarial Nets (GAN). A dual GAN model with intermediate feature sharing was proposed to respectively generate realistic speaker facial details and facial movements synchronized to the given speech.

✦ Multi-tasked discriminator was designed to different attributes of a realistic talking face (e.g. temporal naturalness, identity correctness, audio-lip synchronization).

Speaker Recognition using Cross-modal Knowledge Distillation and Self-Supervised Learning

Individual Research, Advisor: Wenqi Wei, Senior Algorithm Engineer

✦ Used Contrastive Predictive Coding to unsupervisedly extract mixed speech embeddings.

✦ Used a face recognition model as a teacher network to help extract speaker info in mixed embeddings of the self-supervised model in the downstream task via knowledge distillation.

✦ Experiments showed learned embeddings are superior to manually extracted acoustic features.

✦ The method presented robustness to emotional tones by training with facial images. Speaker recognition task using cross-modal knowledge distillation reported 93.4% accuracy, better than training on the labeled speech-along dataset (accuracy: 91.7%) (Dataset: CREMA-D).

Algorithm Department, DeepGlint Technology (Internship)   May. 2020 – Aug. 2020

Individual Research, Advisor: Zechen Hu, Technical Director

Accelerating the Vehicle Plate Recognition Pipeline.

✦ Designed a frame selecting algorithm to extract the highest-quality frame in video streams. The algorithm first locates plates with a confidence threshold then evaluates the quality in the region.

✦ Accelerated deep neural network models through network pruning and distillation.

✦ Proposed to use conditional GAN to rectify plates in various visual angles. The convolutional neural network based model can be accelerated on GPUs while the old version perspective transformation takes a much longer time on CPUs.

Publication

✦ **Li C**, Chen S, Zhao Y, et al. Road Pavement Identification based on Acceleration Signals of Off-road Vehicles Using the Batch Normalized Recurrent Neural Network[C]//2019 IEEE International Conference on Artificial Intelligence and Computer Applications (ICAICA).

✦ Chen Y, Chen S, Zhao Y, Gao Z, **Li C**. Optimized handling stability control strategy for a four in-wheel motor independent-drive electric vehicle[J]. IEEE Access, 2019, 7: 17017-17032.

✦ **Li C**, Chen Y, Wei W, Wang J. Voice2Video: Imagining the talking face behind the voice. Submitted to 2021 International Conference on Acoustics, Speech and Signal Processing (ICASSP).

✦ Chen Y, **Li C**, et al. A Combined Robust Approach based on Auto-Regressive Long-Short Term Memory Network and Moving Horizon Estimation for State-of-charge Estimation of Lithium-ion Batteries. Submitted to International Journal of Energy Research.

Skills

✦ Mechanical Skills: Proficient in CAD tools AutoCAD/UGNX/Solidworks, CAE tools ANSYS/ABAQUS, 3D rendering tools KeyShot.

✦ Programming Skills: Proficient in Python, MATLAB, C++. Comfortable with Linux, ROS.

✦ Deep learning Skills: Proficient in Numpy/Scikit-learn/PyTorch/Tensorflow. Familiar with CNNs, RNNs, Transformers, GANs, GNNs, Self-Supervised Learning.

✦ Other skills: Proficient in Photoshop/Microsoft Office/Latex.

Honors and Awards

✦ First Class Scholarship for Graduate Students (10%).	Sep. 2018 – Jul.2019
✦ Golden Prize of National 3D Industrial Design Competition.	Dec. 2016
(Demo video: https://www.youtube.com/watch?v=nkHCSxH6snw)	
✦ National Patent of Invention (Multi-purpose Intelligent Balancing Scooter).	Sep. 2016
✦ Golden Prize of Computer Design Competition for Chinese College Students.	Jul. 2015