

Brijesh Verma
Ligang Zhang
David Stockwell

Roadside Video Data Analysis: Deep Learning

Chapter 4 Deep Learning Techniques For Roadside Video Data

S Ashworth



Chapter 4 Deep Learning Techniques For Roadside Video Data:

Neural Information Processing Tom Gedeon, Kok Wai Wong, Minho Lee, 2019-12-10 The three volume set of LNCS 11953 11954 and 11955 constitutes the proceedings of the 26th International Conference on Neural Information Processing ICONIP 2019 held in Sydney Australia in December 2019 The 173 full papers presented were carefully reviewed and selected from 645 submissions The papers address the emerging topics of theoretical research empirical studies and applications of neural information processing techniques across different domains The second volume LNCS 11954 is organized in topical sections on image processing by neural techniques learning from incomplete data model compression and optimisation neural learning models neural network applications and social network computing [Advances in Image Processing, Reliability, and Artificial Intelligence](#) Mario J. Divan, Prashant Johri, Francesc Guim, Dmitry Shchemelinin, Marcos Carranza, 2025-12-02 *Advances in Image Processing Reliability and Artificial Intelligence Data Centred Techniques and Applications in Edge Computing* provides a clear outlook of the mechanisms risks challenges and opportunities in system reliability for image processing and AI applications running on edge devices It provides Best Known Configuration BKC and Methods BKM while discussing trends and future works based on current research The content serves as a reference for practitioners and provides a state of the art for researchers in the area It provides foundations to analyse and replicate different applications through use cases It tackles concerns for how reliability aspects i e fault tolerance availability maturity and recoverability are addressed for applications running in an environment that is not fully controlled and exposed to environmental variations Provides an analysis of current challenges and trends in systems reliability AI and image processing in edge computing for supporting different data driven decision making strategies Considers the challenges and opportunities regarding data sovereignty sustainability model lifecycle and AI ethics in edge computing Explains strategies and trends for monitoring and meta monitoring AI deployments and system reliability in edge computing Addresses the top concerns in the reliability AI and image processing in edge computing for supporting distributed decision making Describes an industry perspective for different verticals outlining trends and future research directions [Intelligent Multi-Modal Data Processing](#) Soham Sarkar, Abhishek Basu, Siddhartha Bhattacharyya, 2021-04-08 A comprehensive review of the most recent applications of intelligent multi modal data processing *Intelligent Multi Modal Data Processing* contains a review of the most recent applications of data processing The Editors and contributors noted experts on the topic offer a review of the new and challenging areas of multimedia data processing as well as state of the art algorithms to solve the problems in an intelligent manner The text provides a clear understanding of the real life implementation of different statistical theories and explains how to implement various statistical theories *Intelligent Multi Modal Data Processing* is an authoritative guide for developing innovative research ideas for interdisciplinary research practices Designed as a practical resource the book contains tables to compare statistical analysis results of a novel technique to that of the state of the art techniques and illustrations in the

form of algorithms to establish a pre processing and or post processing technique for model building The book also contains images that show the efficiency of the algorithm on standard data set This important book Includes an in depth analysis of the state of the art applications of signal and data processing Contains contributions from noted experts in the field Offers information on hybrid differential evolution for optimal multilevel image thresholding Presents a fuzzy decision based multi objective evolutionary method for video summarisation Written for students of technology and management computer scientists and professionals in information technology

Intelligent Multi Modal Data Processing brings together in one volume the range of multi modal data processing

Bioinspired Systems for Translational Applications: From Robotics to Social Engineering José Manuel Ferrández Vicente, Mikel Val Calvo, Hojjat Adeli, 2024-05-30 The two volume set LNCS 14674 and 14675 constitutes the proceedings of the 10th International Work Conference on the Interplay Between Natural and Artificial Computation IWINAC 2024 which took place in Olh o Portugal during June 4 7 2024 The 99 full papers presented in these proceedings were carefully reviewed and selected from 193 submissions They were organized in topical sections as follows

Part I Machine learning in neuroscience artificial intelligence in neurophysiology neuromotor and cognitive disorders intelligent systems for assessment treatment and assistance in early stages of Alzheimer s disease and other dementias socio cognitive affective and physiological computing affective computing and context awareness in ambient intelligence learning tools to lecture

Part II Machine learning in computer vision and robotics bio inspired computing approaches social and civil engineering through human AI translations smart renewable energies advancing AI algorithms in the renewable energy industry bioinspired applications

Intelligent Systems and Applications Kohei Arai, Supriya Kapoor, Rahul Bhatia, 2020-08-25 The book Intelligent Systems and Applications Proceedings of the 2020 Intelligent Systems Conference is a remarkable collection of chapters covering a wider range of topics in areas of intelligent systems and artificial intelligence and their applications to the real world The Conference attracted a total of 545 submissions from many academic pioneering researchers scientists industrial engineers students from all around the world These submissions underwent a double blind peer review process Of those 545 submissions 177 submissions have been selected to be included in these proceedings As intelligent systems continue to replace and sometimes outperform human intelligence in decision making processes they have enabled a larger number of problems to be tackled more effectively This branching out of computational intelligence in several directions and use of intelligent systems in everyday applications have created the need for such an international conference which serves as a venue to report on up to the minute innovations and developments This book collects both theory and application based chapters on all aspects of artificial intelligence from classical to intelligent scope We hope that readers find the volume interesting and valuable it provides the state of the art intelligent methods and techniques for solving real world problems along with a vision of the future research

Roadside Video Data Analysis Brijesh Verma, Ligang Zhang, David Stockwell, 2017-04-28 This book highlights the methods and applications for roadside video data

analysis with a particular focus on the use of deep learning to solve roadside video data segmentation and classification problems It describes system architectures and methodologies that are specifically built upon learning concepts for roadside video data processing and offers a detailed analysis of the segmentation feature extraction and classification processes Lastly it demonstrates the applications of roadside video data analysis including scene labelling roadside vegetation classification and vegetation biomass estimation in fire risk assessment *Bowker's Complete Video Directory*, 1998, 1998 *Index to IEEE Publications* Institute of Electrical and Electronics Engineers, 1995 Issues for 1973 cover the entire IEEE technical literature *Government Reports Annual Index*, 1986 **Microlog, Canadian Research Index**, 1989 An indexing abstracting and document delivery service that covers current Canadian report literature of reference value from government and institutional sources *Government Reports Announcements & Index*, 1996 **Science Citation Index**, 1994 Vols for 1964 have guides and journal lists *Bibliography of Agriculture*, 1986 **Deep Learning for Video**

Understanding Zuxuan Wu, Yu-Gang Jiang, 2024-08-01 This book presents deep learning techniques for video understanding For deep learning basics the authors cover machine learning pipelines and notations 2D and 3D Convolutional Neural Networks for spatial and temporal feature learning For action recognition the authors introduce classical frameworks for image classification and then elaborate both image based and clip based 2D 3D CNN networks for action recognition For action detection the authors elaborate sliding windows proposal based detection methods single stage and two stage approaches spatial and temporal action localization followed by datasets introduction For video captioning the authors present language based models and how to perform sequence to sequence learning for video captioning For unsupervised feature learning the authors discuss the necessity of shifting from supervised learning to unsupervised learning and then introduce how to design better surrogate training tasks to learn video representations Finally the book introduces recent self training pipelines like contrastive learning and masked image video modeling with transformers The book provides promising directions with an aim to promote future research outcomes in the field of video understanding with deep learning

Applications of Deep Learning and Computer Vision in Large Scale Quantification of Tree Canopy Cover and Real-time Estimation of Street Parking Bill Yang Cai, 2018 A modern city generates a large volume of digital information especially in the form of unstructured image and video data Recent advancements in deep learning techniques have enabled effective learning and estimation of high level attributes and meaningful features from large digital datasets of images and videos In my thesis I explore the potential of applying deep learning to image and video data to quantify urban tree cover and street parking utilization Large scale and accurate quantification of urban tree cover is important towards informing government agencies in their public greenery efforts and useful for modelling and analyzing city ecology and urban heat island effects We apply state of the art deep learning models and compare their performance to a previously established benchmark of an unsupervised method Our training procedure for deep learning models is novel we utilize the abundance of openly available

and similarly labelled street level image datasets to pre train our model We then perform additional training on a small training dataset consisting of GSV images We also employ a recently developed method called gradient weighted class activation map Grad CAM to interpret the features learned by the end to end model The results demonstrate that deep learning models are highly accurate can be interpretable and can also be efficient in terms of data labelling effort and computational resources Accurate parking quantification would inform developers and municipalities in space allocation and design while real time measurements would provide drivers and parking enforcement with information that saves time and resources We propose an accurate and real time video system for future Internet of Things IoT and smart cities applications Using recent developments in deep convolutional neural networks DCNNs and a novel intelligent vehicle tracking filter the proposed system combines information across multiple image frames in a video sequence to remove noise introduced by occlusions and detection failures We demonstrate that the proposed system achieves higher accuracy than pure image based instance segmentation and is comparable in performance to industry benchmark systems that utilize more expensive sensors such as radar Furthermore the proposed system can be easily configured for deployment in different parking scenarios and can provide spatial information beyond traditional binary occupancy statistics

Machine and Deep Learning Techniques for Real-time In-vehicle Fog Detection and Speed Behavior Investigation Utilizing the SHRP2

Naturalistic Driving Study Data Md Nasim Khan,2018 The negative impact of reduced visibility on driver performance has been recognized as one of the major causes of motor vehicle crashes Proper assessment of real time visibility condition is therefore crucial for safe driving especially during adverse weather including fog Although many studies have investigated various visibility detection methods most of them had several limitations and did not provide reliable real time prediction capabilities This study describes some unique and advanced data mining techniques for detecting real time fog and visibility conditions utilizing video data from the Second Strategic Highway Research Program SHRP2 Naturalistic Driving Study NDS dataset In this study Gray Level Co occurrence Matrix GLCM features were extracted and significant texture features including Contrast Correlation Energy and Homogeneity were selected as classification parameters for Support Vector Machine SVM and K Nearest Neighbors K NN classifiers In addition Convolutional Neural Network CNN Deep Learning technique was also examined for fog detection Although the analysis was done initially on a dataset consisted of binary weather conditions including clear and fog it has been successfully extended to include different levels of fog i e near fog and distant fog The classifications were conducted to leverage the SHRP2 NDS data by adding additional trajectory level weather and visibility variables to the original data in an automated fashion While the prediction accuracy of the first analysis was approximately 92% and 91% for the SVM and K NN classifier respectively the CNN Deep Learning technique produced a far better classification results with an accuracy close to 99% As expected the prediction accuracy of the second analysis with more refined weather categories was relatively less compared to the first analysis where the SVM and the K NN classifier

produced an accuracy of about 89% and 88% respectively and the CNN provided an accuracy of about 97% The methods developed in this study are based on a single in vehicle camera and can be used to detect daytime fog in real time This thesis also utilized the data from the SHRP2 NDS database to understand driver behavior in general and speed selection in particular during clear and foggy weather conditions In this study a preliminary analysis and an ordered logit model were developed to evaluate driver speed behavior in fog and clear weather conditions The preliminary analysis showed a Weibull speed distribution in heavy fog under free flow conditions while the speeds were normally distributed in clear weather for the matching dataset i e same driver vehicle route and traffic state Descriptive analysis indicated about 10% reduction in speed during near fog and about 3% reduction in speed during distant fog The calibrated speed selection model found weather related factors including fog visibility and surface conditions to have a significant impact on driver speed selection For instance results showed that drivers were more likely to select significantly lower speeds during foggy weather conditions More specifically the odds of drivers reducing their speeds from the posted speed limit were 1.31 and 1.28 times higher for drivers traveling in near fog and distant fog respectively compared to drivers who were driving in clear weather conditions The results from this study will unlock new horizons and potentials in conducting adverse weather related research utilizing the SHRP2 NDS data The advanced Machine and Deep Learning techniques introduced in this study could be extended to other weather and surface conditions Moreover the findings from this study can also be incorporated into Advanced Driving Assistance Systems ADAS and Connected Variable Speed Limit VSL algorithms to improve their reliability and accuracy

Deep Learning and Its Applications for Vehicle Networks Fei Hu, Iftikhar Rasheed, 2023-05-12 Deep Learning DL is an effective approach for AI based vehicular networks and can deliver a powerful set of tools for such vehicular network dynamics In various domains of vehicular networks DL can be used for learning based channel estimation traffic flow prediction vehicle trajectory prediction location prediction based scheduling and routing intelligent network congestion control mechanism smart load balancing and vertical handoff control intelligent network security strategies virtual smart and efficient resource allocation and intelligent distributed resource allocation methods This book is based on the work from world famous experts on the application of DL for vehicle networks It consists of the following five parts I DL for vehicle safety and security This part covers the use of DL algorithms for vehicle safety or security II DL for effective vehicle communications Vehicle networks consist of vehicle to vehicle and vehicle to roadside communications This part covers how Intelligent vehicle networks require a flexible selection of the best path across all vehicles adaptive sending rate control based on bandwidth availability and timely data downloads from a roadside base station III DL for vehicle control The myriad operations that require intelligent control for each individual vehicle are discussed in this part This also includes emission control which is based on the road traffic situation the charging pile load is predicted through DL and vehicle speed adjustments based on the camera captured image analysis IV DL for information management This part covers some

intelligent information collection and understanding We can use DL for energy saving vehicle trajectory control based on the road traffic situation and given destination information we can also natural language processing based on DL algorithm for automatic internet of things IoT search during driving V Other applications This part introduces the use of DL models for other vehicle controls Autonomous vehicles are becoming more and more popular in society The DL and its variants will play greater roles in cognitive vehicle communications and control Other machine learning models such as deep reinforcement learning will also facilitate intelligent vehicle behavior understanding and adjustment This book will become a valuable reference to your understanding of this critical field

Intelligent Image and Video Analytics El-Sayed M. El-Alfy, George Bebis, Mengchu Zhou, 2023-04-12 Video has rich information including meta data visual audio spatial and temporal data which can be analysed to extract a variety of low and high level features to build predictive computational models using machine learning algorithms to discover interesting patterns concepts relations and associations This book includes a review of essential topics and discussion of emerging methods and potential applications of video data mining and analytics It integrates areas like intelligent systems data mining and knowledge discovery big data analytics machine learning neural network and deep learning with focus on multimodality video analytics and recent advances in research applications Features Provides up to date coverage of the state of the art techniques in intelligent video analytics Explores important applications that require techniques from both artificial intelligence and computer vision Describes multimodality video analytics for different applications Examines issues related to multimodality data fusion and highlights research challenges Integrates various techniques from video processing data mining and machine learning which has many emerging indoors and outdoors applications of smart cameras in smart environments smart homes and smart cities This book aims at researchers professionals and graduate students in image processing video analytics computer science and engineering signal processing machine learning and electrical engineering

Video Based Machine Learning for Traffic Intersections Tania Banerjee, Xiaohui Huang, Aotian Wu, Ke Chen, Anand Rangarajan, Sanjay Ranka, 2023-10-17 Video Based Machine Learning for Traffic Intersections describes the development of computer vision and machine learning based applications for Intelligent Transportation Systems ITS and the challenges encountered during their deployment This book presents several novel approaches including a two stream convolutional network architecture for vehicle detection tracking and near miss detection an unsupervised approach to detect near misses in fisheye intersection videos using a deep learning model combined with a camera calibration and spline based mapping method and algorithms that utilize video analysis and signal timing data to accurately detect and categorize events based on the phase and type of conflict in pedestrian vehicle and vehicle vehicle interactions The book makes use of a real time trajectory prediction approach combined with aligned Google Maps information to estimate vehicle travel time across multiple intersections Novel visualization software designed by the authors to serve traffic practitioners is used to analyze the efficiency and safety of intersections The software offers two

modes a streaming mode and a historical mode both of which are useful to traffic engineers who need to quickly analyze trajectories to better understand traffic behavior at an intersection Overall this book presents a comprehensive overview of the application of computer vision and machine learning to solve transportation related problems Video Based Machine Learning for Traffic Intersections demonstrates how these techniques can be used to improve safety efficiency and traffic flow as well as identify potential conflicts and issues before they occur The range of novel approaches and techniques presented offers a glimpse of the exciting possibilities that lie ahead for ITS research and development Key Features Describes the development and challenges associated with Intelligent Transportation Systems ITS Provides novel visualization software designed to serve traffic practitioners in analyzing the efficiency and safety of an intersection Has the potential to proactively identify potential conflict situations and develop an early warning system for real time vehicle vehicle and pedestrian vehicle conflicts

Deep-Learning-based Video Analysis for Human Action Evaluation Chen Du, 2022 As video analysis provides an automatic solution to extract meaningful information from the video content it can be applied in healthcare to evaluate human action patterns for various purposes such as biometrics estimation and performance assessment In recent years the fast development of deep learning and portable medical sensors has led to more affordable and accurate computer vision based measurements for human action patterns thus enabling a more efficient video analysis system for action evaluation in home and clinic environments We investigate the novel usage of video analysis for healthcare monitoring purposes including objective biometrics estimation and subjective action quality assessment We propose a deep learning framework to extract spatial temporal features and estimate biometrics or performance scores from 3D body landmarks using a graph convolutional neural network which offers a portable solution to obtain gold standard biometrics with 3D multi joint coordination underlying body movements and can provide real time feedback of movement performance for rehabilitation exercises For biometrics estimation in Chapter 2 we propose two single task models for video level and frame level estimation respectively and a multi task learning approach to estimate CoP metrics on two different temporal levels in parallel To facilitate this line of research we collect and release a novel computer vision based 3D body landmark dataset using pose estimation We extend our framework to a traditional kinematics dataset collected by on body reflective markers by using adaptive graph convolution For action quality assessment we propose a deep learning framework for automatic assessment of physical rehabilitation exercises using a graph convolutional network with self supervised regularization in Chapter 3 To further improve the accessibility of the real time CoP metrics estimation system we investigate a view invariant video level CoP metrics estimation framework using a single RGB camera in Chapter 4 which could significantly benefit the data collection in home and clinic environments We also explore a semi supervised learning framework for video level CoP metrics estimation for partially labeled data with only a small portion of labels in Chapter 5 Our proposed methods potentially enable a more affordable comprehensive and portable virtual therapy system than is

available with existing tools

Embracing the Tune of Phrase: An Psychological Symphony within **Chapter 4 Deep Learning Techniques For Roadside Video Data**

In a global eaten by screens and the ceaseless chatter of instantaneous conversation, the melodic beauty and mental symphony produced by the prepared word usually disappear in to the background, eclipsed by the constant sound and disturbances that permeate our lives. However, situated within the pages of **Chapter 4 Deep Learning Techniques For Roadside Video Data** a stunning fictional treasure full of natural thoughts, lies an immersive symphony waiting to be embraced. Constructed by an elegant musician of language, that fascinating masterpiece conducts readers on a mental journey, skillfully unraveling the hidden melodies and profound impact resonating within each cautiously constructed phrase. Within the depths with this poignant assessment, we shall investigate the book is main harmonies, analyze their enthralling publishing design, and submit ourselves to the profound resonance that echoes in the depths of readers souls.

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