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VEHICLE TRACKING WITH CAR FOLLOWING MODEL&VS-IMM

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Abstract- *Now a day the number of vehicles are increases, it leads to traffic problems. Cooperation between vehicles facilitates traffic management and road safety. A car following model is used to determine how vehicles follow one another on the road way. This model maintains a minimum space and time gap between it. This paper presents a novel multi-vehicle tracking algorithm for unidirectional case. It is an integration of car following model(CFM) and road constraints for road safety. For updating the state estimates of car following clusters stacked-update strategy is used. Posterior Cramer-Rao Lower Bound is derived for best possible accuracy in any sensor field. Variable Structure Interacting Multiple Model algorithm(VS-IMM) is used to handle motion deviation from the CFM.*

Key Words: **CFM,VS-IMM,PCRLB,CFM-KF, Stacked Update strategy..**

1. INTRODUCTION

Now a days comfort and safety are more important in traffic because rapid increase in vehicles. Recently introduced a technique, Car Following Model focusing for safety. Previously, Social Force Model being used for model vehicle dynamics. But it requires pedestrians and not accurate so we used CFM. It describe the vehicle dynamics as the process of one vehicle following another. This method depends on the acceleration of the leading vehicle. This acceleration define a safe distance for avoiding collisions. This include Action Point(AP)model, Cellular Automation Model and fuzzy logic based model. But it does not applicable in high traffic volume so integrate car following model into the tracking process with road constraints. It applicable only in one directional way.

One dimensional road can be represented by starting point (Si),Unit direction vector (dj) and segment length. The acceleration of the following vehicle can be found out by, "$a_F(t) = C_1 v(t-T)+C_2 x(t-T)+C_3 v_F(t-T)+c$" where vF is the speed of the following vehicle, v and x are the relative distance and speed, respectively between the leading and following vehicle. In the above, T is the reaction time for drivers, while C1, C2, C3, c and T are the parameters that are determined by experiments. The parameter C indicates the aggressiveness of driving behavior. That determines the distance between the two vehicles. That is aggressive drivers can be modeled by a low absolute value which means they follow the leading vehicle very closely.

Sensor provides position data and it will converted to the ground coordinate before being entered into the tracking system.

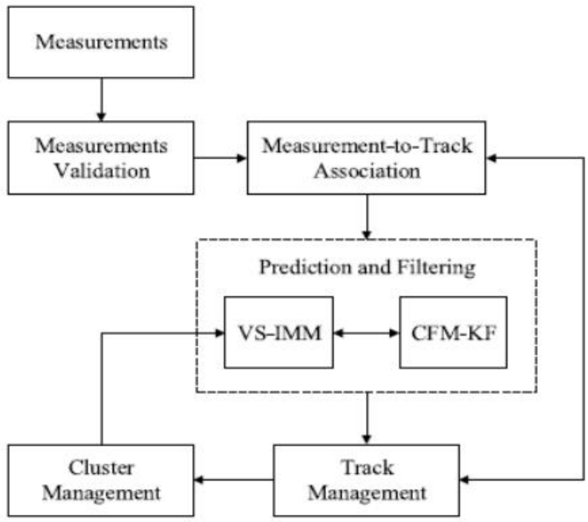

Fig: CFM-based multi-vehicle tracking algorithm with integrated road map

This figure taken from Multi-Vehicle Tracking With Road Maps and Car-Following Models proposed by Xavier N. Fernando et.al.

The CFM-Kalman filter used to update the stacked vehicle state of each car-following cluster. It is processed in three steps such as state prediction, measurement prediction and state update. State update means ,state of all tracks in the same car following cluster are dependent on each other.

Variable Structure Interacting Multiple Model(VM-IMM) helps to find the violation of the CFM in Car-following pair of a Car following cluster.

Measurements will be validated before data association to eliminate false alarms and to reduce the number of candidate assignments. The validation performed in two stages such as On-road constraint validation and Gating. On-road constraint used to remove false measurements. A gate is used for measurement to track association for each track based on its predicted measurement. By using this value falling within the gate and it is considered for associating with this track.

Data association means measurement to track association deals with measurement origin uncertainity in MTT. The status of existing tracks updation and new tracks are initialized based on this association result. Score function method method is used to confirm tentative tracks and terminate dead ones.

Based on the results of track management, the structure of car following clusters is updated by considering four potential types of changes to car following clusters. They are Track insertion, Track deletion, Cluster merging, Cluster splitting. Track insertion means when a target is confirmed during track management and it is inserted into the car following cluster. Confirmed track is deleted during track management and it also removed from the car following cluster. This process done in track deletion. If car following cluster approaches its leading car following cluster then these two clusters are merged into one and this process is called cluster merging. Cluster may split when a vehicle in the car-following cluster does not follow the leading vehicle to accelerate or when a track in the middle of the cluster is deleted this process is called cluster splitting.

Posterior Cramer Rao lower bound(PCRLB) is also used for solving multi-vehicle tracking problem with the integrated road map and the CFM. The CRLB is the inverse of the Fisher information matrix. And it provides a lower bound on the minimum mean square (MSE) for unbiased static estimators. PCRLB mainly used for measure the best possible accuracy from any sensors and quantify the performance of the track.

2. LITERATURE SURVEY

Structured Branching Multiple Hypotheses Tracker(SB-MHT)[1] finds several association scenario in the road intersection. It can modelize the classification information for each sensor type. It track multiple ground targets with airborne GMTI sensors and helps to track maneuvering ground targets and correct the ground tactical solution. Interactive Multiple Model account the network facilities in the road. Another method Track Segment Associations(TSA) defines the classification information in the log-likelihood function.

High density wide area aerials[2] videos are used for maintaining multiple object centric associations for each track. It also helps to avoid pitfalls of global minimization of data association cost. Object states are connected many to many data associations per track. Weighted hypothetical values are used for better handle occlusions, mis-detections and split or merged detections. For simultaneous moving object detection two frame differencing method is used.

The Enhanced maps [3]are mainly used in lane level vehicle navigation. It will characterize the road with more completeness. Here the road details are stored in digital map that exploits the definition of clothoids to follow the road shape. E map provides high accuracy and road safety to the advanced driver assistance system(ADAS).

This paper introduce PCRLB[4] based multi sensor array management for multi target tracking. PCRLB must evaluate the effect of uncertain measurements. It manage the array of sensors to track multiple targets in the presence of clutter and it check missed detections and false alarms. It have three complicating factors such as physical limitations (communication, bandwidth), Assosiations of measurements to target &clutter are unknown and total number of targets in the surveillance region is unknown and possibly time varying. To avoid this use bi-criterion and Multitarget information reduction matrix(IRM).It will reduce the computational load and can used offline mode also.

Kalman filter[5] is used to estimate the states of a dynamic system. Incorporating the equality constraints in the kalman filter use a rigorous analytic method, which improves the prediction accuracy of the filter. It can be easily used in nonlinear vehicle tracking problem.

3. CONCLUSIONS

This survey has been performed mainly for security in traffic. Car-following model is a method used to determine how vehicles follow one another on a roadway. This model is that a vehicle will maintain a minimum space and time gap between it and the vehicle that precedes. But in high traffic volume and limited resources of vehicles. The vehicle interacts with their neighbor. To avoid this problem, integrate CFM into the tracking process with road constraints. Which describes based on the acceleration of the leading vehicle. This acceleration of the vehicle helps to define safe distance for avoiding collisions. A stacked vector strategy is used for update the estimate of car following cluster. To obtain best accuracy result from any sensor field use Posterior Cramer Rao Lower Bound technique. And it helps to find computational load of the vehicle also. Sometimes the vehicles deviate from the CFM ,it leads to many problems in traffic. To find this Variable Structure Interacting Multiple Model is used.

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REFERENCES

[1] Y. Cheng and T. Singh, "Efficient particle filtering for road-constrained target tracking," IEEE Trans. Aerosp. Electron. Syst., vol. 43, no. 4, pp. 1454–1469, Oct. 2007.

[2] D. Simon and T. L. Chia, "Kalman filtering with state equality constraints," IEEE Trans. Aerosp. Electron. Syst., vol. 38, no. 1, pp. 128–136, Jan. 2002

[3]B. Pannetier, V. Nimier, and M. Rombaut, "Multiple ground target tracking with a GMTI sensor," in Proc. IEEE Int. Conf. MFI, Sep. 2006, pp. 230–236

[4]. Saleemi and M. Shah, "Multiframe many-many point correspondence for vehicle tracking in high density wide area aerial videos," Int. J. Comput. Vis., vol. 104, no. 2, pp. 198–219, Sep. 2013.

[5]D. Helbing and P. Molnár, "Social force model for pedestrian dynamics," Phys. Rev. E, Stat. Phys. Plasmas Fluids Relat. Interdiscip. Top., vol. 51, pp. 4282–4286, May 1995

[6]D. Betaille and R. Toledo-Moreo, "Creating enhanced maps for lanelevel vehicle

[7]Y. Bar-Shalom, T. Kirubarajan, and C. Gokberk, "Tracking with classification-aided multiframe data association," IEEE Trans. Aerosp. Electron. Syst., vol. 41, no. 3, pp. 868–878, Jul. 2005.

[8]P. Tichavsky, C. H. Muravchik, and A. Nehorai, "Posterior CramerRao bounds for discrete-time nonlinear filtering," IEEE Trans. Signal Process., vol. 46, no. 5, pp. 1386–1396, May 1998.