

<b>ProFusion/PReVENT Glossary</b>					
<b>Term</b>	<b>Definition</b>	<b>References</b>	<b>Alternative definition</b>	<b>References alt. definition</b>	<b>Notes</b>
A priori estimate	The role of an initial (or starting) value of the state vector in order to obtain a solution	Gauss (1809); D. Hall (1992)			
Accuracy (of measurement)	Accuracy of sensor measurements in terms of statistics	David Hall (1992)			
Application	A program (as a word processor or a spreadsheet) that performs one of the important tasks for which a computer is used	EAST-EAA (Webster)			
Application Programming Interface (API)	A software interface that enables <b>applications</b> to communicate with each other. An API is the set of programming language constructs or statements that can be coded in an application program to obtain the specific functions and services provided by an underlying operating system or service program.	EAST-EAA ( <a href="http://www-3.ibm.com/ibm/terminology/">http://www-3.ibm.com/ibm/terminology/</a> )			
Architecture	The fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution.	EAST-EAA (IEEE Recommended Practice for Architectural Description of Software-Intensive Systems; IEEE Standard P1471, IEEE Architecture Working Group (AWG))	An architecture is a structure of components , their relationships, and the principles and guidelines governing their design and evolution over time	IEEE	
Assignment	The final step in the association process with the actual assignment of observation to observation, observation to track.	David Hall (1992)			In multi sensor system it can be extended to track to track assignment.
Association measures	Selection of measures or metrics to quantify the closeness or similarity between observations.	David Hall (1992)			It can be extended to tracks.
Bayes' formula	Provides a relationship between the a priori probability of a hypothesis, the conditional probability of an observation given a hypothesis and the a posteriori probability of the hypothesis	David Hall (1992)			
Bayesian inference	Updates the probabilities of alternative hypotheses, based on observational evidence using Bayes formula.	David Hall (1992)			
Classical inference (methods)	Seek to determine the validity of a proposed hypothesis (versus an alternative hypothesis) based on empirical probabilities.	David Hall (1992)			
Cluster analysis	Is a generic name for a wide variety of procedures (heuristic methods) that can be used to group data into natural groupings or clusters.	David Hall (1992)			
Configuration	The arrangement of hardware and/or software elements in a system.	EAST-EAA (Functional safety: safety instrumented systems for the process industry section; Part 1: Framework, definitions, system, hardware and software requirements; IEC2002.)	Adaptation of an application to different physical targets or functional strategies	EAST-EAA (Functional safety: safety instrumented systems for the process industry section; Part 1: Framework, definitions, system, hardware and software requirements; IEC2002.)	
Consistency	Of a state estimator (filter) is the property of fulfilling the following consistency criteria: (1) The state errors are acceptable as zero mean and have magnitude commensurate with the state covariance as yielded by the filter, (2) The innovations have the same property, (3) The innovations are acceptable as white.	Bar-Shalom (2001)			
Course	The direction of the velocity vector in the horizontal plane	Bar-Shalom (2001)			
Coverage (spatial of sensor)	Spatial volume covered by the sensor. For scanning sensors this may be described by the instantaneous field of view, the scan pattern volume, and the total field of regard achievable by moving the scan pattern.	David Hall (1992)			
Data	Information output by a sensing device or organ that includes both useful and irrelevant or redundant information and must be processed to be meaningful.	EAST-EAA (Webster)	Data is the software implementation of an information. It can be exchanged between software components. A data is persistent. It is persistent in memory.	EAST-EAA	
Data association	The problem of determining which observation pairs (if any) belong together, representing observations of the same entity.	David Hall (1992)			
Data fusion	see Information Fusion				
Dead reckoning	A technique used in conjunction with other GPS-based positioning solution to maintain an estimate of position during periods when there is poor or no access to the GPS satellite broadcasts	L. Vlacic et al (2001) Intelligent Vehicle Technologies			
Decision	The selection of one out of a set of discrete alternatives	Bar-Shalom (2001)			
Decision-level fusion	Seeks to process identity declarations from multiple sensors to achieve a joint declaration of identity	David Hall (1992)			

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Dempster-Shafer method (inference)	Analogous to the Bayesian inference, updates an a priori mass density function to obtain an a posteriori evidential interval that quantifies the credibility (measure of belief) of a proposition and its plausibility (lack of evidence refuting the hypotheses).	David Hall (1992)			
Detection Performance (of sensor)	Detection characteristics (false alarm rate, detection probabilities and ranges) for a calibrated target characteristic in a given noise background	David Hall (1992)			
Divergence	The phenomenon of a filter yielding unacceptably large estimation errors because of: (1) modelling errors, (2) numerical errors, (3) programming errors	Bar-Shalom (2001)			
Dynamic modelling	The need for accurate equations of motion to describe the evaluation of a state vector in time	Gauss (1809); D. Hall (1992)			
Early fusion	An information fusion approach (see Information Fusion), which is based on feature data as input in contrast to track fusion (see Track Fusion). The basic idea is to do the major part of the sensor information processing, analysis and data fusion combined at one place to prevent inconsistencies in the data interpretation and objects modelling.				
Ego-vehicle	The reference vehicle that carries intelligent vehicle technologies				
Electronic Control Unit (ECU)	Small embedded computer system consisting out of at least one CPU and corresponding periphery which is placed in one housing.	EAST-EAA			
Environment model	An abstraction of the road environment and the relationships between road elements				
Estimation	Is the process of inferring the value of a quantity of interest from indirect, inaccurate and uncertain observations	Bar-Shalom (2001)			
Feature	An abstraction of the raw data intended to provide a reduced data set that accurately and concisely represents the original information.	David Hall (1992)			
Feature extraction	The transformation of the raw data into a feature vector	David Hall (1992)			
Filter tuning	The procedure to match the process noise to suitably model the disturbances, e.g. target maneuvers	Bar-Shalom (2001)			
Filtering	Is the estimation of the (current) state of adynamic system eliminating the undesired noise signal	Bar-Shalom (2001)			
Flexibility	The ability of a system to adapt to new, different or changing requirements.	EAST-EAA (J. W. Bracket; Software Requirements; SEI Curriculum Module SEICM-19-1.2, Carnegie Mellon University, 1990.)			
Function	A task, action, or activity that must be accomplished to achieve a desired outcome	EAST-EAA (IEEE Guide for Developing System Requirements Specifications; IEEE Standard P1233a, 1998.);			
Functional Specification	Specification of the normal function of the system.	EAST-EAA (Safety terms for automation systems reliability and safety of complex systems; VDI/VDE 2000.)			
Functionality	A synthesis of functions to provide a major functional entity of a unit.	EAST-EAA			
Fusion Framework	A set of processes that provide a viable solution to the data fusion domain (see Fusion functional model)				references call it Fusion Functional model; JDJL is the most common example of such a framework
Fuzzy Sets (Fuzzy Logic)	Seeks to address problems in which imprecision is an inherent aspect of areasoning process.	Zadeh			
Gateway	A functional unit that interconnects two computer networks with different network architectures. A gateway connects networks or systems of different architectures. A bridge interconnects networks or systems with the same or similar architectures.	EAST-EAA ( <a href="http://www-3.ibm.com/ibm/terminology/">http://www-3.ibm.com/ibm/terminology/</a> ).	A functional unit that connects two networks or sub-networks having different characteristics, such as different protocols or different policies concerning security or transmission priority.	EAST-EAA ( <a href="http://www-3.ibm.com/ibm/terminology/">http://www-3.ibm.com/ibm/terminology/</a> ).	
Gating	Performs an initial screening of to eliminate unlikely observation-to-observation or observation-to-track pairs.	David Hall (1992)			It can be extended to gating of tracks.
Guidance	Determines an appropriate sequence of actions to reach a destination. It is acontrol problem based on inforamtion obtained by a navigation system and a tracking problem when the destination is a moving object	Bar-Shalom (2001)			
Heading	The pointing direction of the vehicle	Bar-Shalom (2001)			Heading is the direction you think you are going while course is the direction you are actually going
Identity fusion	Seeks to combine data from multiple sensors to establish the identity of objects.	David Hall (1992)			

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Inertial Navigation System	Is a dead reckoning system that provides a self-contained, nonjammable, nonradiating means of navigation. It can be used as a stand alone system or combined with other navigation systems. It has three basic functions: sensing, computing and outputting.	Bar-Shalom (2001)			
Inference	see Statistical Inference				
Information Fusion (1)	Information Fusion encompasses the theory, techniques and tools conceived and employed for exploiting the synergy in the information acquired from multiple sources (sensor, databases, information gathered by human, etc.) such that the resulting decision or action is in some sense better than (qualitatively or quantitatively, in terms of accuracy, robustness and etc.) than would be possible if any of these sources were used individually without such synergy exploitation.		Events, activities and movements are correlated and analyzed as they occur in time and space, to determine the location, identity and status of individual objects, to assess the situation, to qualitatively and quantitatively determine threats and to detect patterns in activity that reveal intent or capability.		
Information Fusion (2)	Information fusion is an Information Process dealing with the association, correlation, and combination of data and information] from single and multiple sensors or sources to achieve refined estimates of parameters, characteristics, events, and behaviors] for observed entities in an observed field of view. It is sometimes implemented as a Fully Automatic process or as a Human-Aiding process for Analysis and/or Decision Support.	James Llinas (2001)			
Information Fusion domain	The problem of information fusion				
Integrated system	Two or more in-vehicle devices, which provide information to, or receive output from, the driver of a motor vehicle, whose output have been combined or harmonised	ISO TC22/SC13 WG8 PWI LCT 018			
Intelligent vehicle technologies	Technologies that are enabling enhancement in road safety, road transport, operational efficiency and increasing driver pleasure	L. Vlacic et al (2001) Intelligent Vehicle Technologies			
JDL model	Four levels are defined: Level 0 — Sub-Object Data Association & Estimation: pixel/signal level data association and characterization Level 1 — Object Refinement: observation-to-track association, continuous state estimation (e.g. kinematics) and discrete state estimation (e.g. target type and ID) and prediction Level 2 — Situation Refinement: object clustering and relational analysis, to include force structure and cross force relations, communications, physical context, etc. Level 3 — Impact Assessment: [Threat Refinement]: threat intent estimation, [event prediction], consequence prediction, susceptibility and vulnerability assessment Level 4 – Process Refinement: adaptive search and processing (an element of resource management)	James Llinas (2002); US Joint Directors of Laboratories Data Fusion Group			
Kalman filter	The optimal estimator in the least square sense	Kalman (1960)	The optimal minimum mean square error state estimator under the Gaussian assumption for the initial state (or initial state error) and all the noises entering into the system	Bar-Shalom (2001)	
Knowledge based techniques	Such as expert systems and logical templates may be used to perform identity declarations, using physical models and attempt to emulate the cognitive approach used by humans in performing identity recognition.	David Hall (1992)			
Low level fusion	see information fusion				The sources are sensor raw data
Modularity	Property of an architecture being composed of modules, i.e. of units that may be handled (implemented, exchanged...) without internal changes. This property requires well-defined interfaces of the modules. Furthermore, for easy handling, a proper tailoring of the modules is necessary.	EAST-EAA			
Multi-Level Fusion	The Multi-Level Fusion approach means that several levels of fusion exist. Information and data which are provided by a sensor about a specific object in the real world scene are fused on several different levels of abstraction. These can be for instance components on the signal level, the feature level and the track level.	University of Chemnitz			
Navigation	Is the estimation of the state of the platform ("own ship") on which the sensor is located	Bar-Shalom (2001)			
Observability	The issue of how many and what types of observations are necessary to develop an estimate of the state vector.	Gauss (1809); D. Hall (1992)			
Observation	Measurement				

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Observation	Is a collective term that is used to refer to all the observed (or measured) quantities included in a report (or detection) output from a sensor	Blackman (1999)			
Observation noise	A probabilistic interpretation of observational noise	Gauss (1809); D. Hall (1992)			
Optimal estimator	Is a computational algorithm that processes observations (measurements) to yield an estimate of a variable of interest, which optimises a certain criterion.	Bar-Shalom (2001)			
Parametric association	Seeks to associate observations to other observations or observations to existing tracks. This is accomplished by defining a measure of association that quantifies the closeness between pairs. Commonly used association measures include correlation coefficients, distance measures, association coefficients or probability similarity measures.	David Hall (1992)			
Perception					
PI2 Functional Model	Level0: Signal level; Level1: Object level; Level1a: Feature level; Level1b: Track level; Level1c: Object level (equals Level1) Level2: Situation level; Level3: Application Level				
Positional fusion	Seeks to combine parametrical data from multiple sensors to obtain the most accurate estimate of an entity's position and velocity.	David Hall (1992)			
Prediction	Is the estimation of the state at time beyond the data interval that is based upon data up to an earlier time. Types of prediction are: fixed-point prediction, fixed-lead prediction, fixed-interval prediction	Bar-Shalom (2001)			
Realtime	System which has to finish the processing within a specific time interval (deadline) dedicated by its environment.	EAST-EAA			
Resolution (spatial/temporal of sensor)	Ability to distinguish between two or more targets in space or time	David Hall (1992)			
Road element	A component of the road (road borders, lanes, traffic signs, etc.) or a road user (vehicle, pedestrian, ego-vehicle, cyclist, etc.)				
Sensor	A device that detects physical parameters of the environment				
Sensor data fusion	see Information Fusion				it focuses on the explicit use of "sensors"
Sensor data fusion inputs	Include three basic components: (1) data observed by sensors, (2) data and command input by human operators or users, and (3) a priori data from a preestablished database	David Hall (1992)			
Sensor raw data	The output of a sensor based on physical principles (e.g. pixel array, doppler velocity etc.)				
Sensor system	A sensor or a set of sensors (not necessarily homogeneous) that perform a specific desired task				
Situation	The way in which something is placed in relation to the environment	US Joint Directors of Laboratories Data Fusion Group			
Situation assessment	Establishes a view of activities, manoeuvres, locations and properties of road elements and from it estimates what is happening or going to happen and the severity which events will occur;	S. Blackman (2001); A. Polychronopoulos (2004)	the first step is to develop the appropriate level of domain specific knowledge for the road elements and the second to develop a decision making process that is able to codify and manipulate the knowledge	S. Blackman (2001); A. Polychronopoulos (2004)	
Smoothing	Or retrodiction is the estimation of the state at time within the data interval that is based on data up to a later time. Types of smoothing are: fixed-point smoothing, fixed-lead smoothing, fixed-interval smoothing	Bar-Shalom (2001)			
Specification	Precise (formal if possible) description of an object within the scope of the task.	EAST-EAA (Safety terms for automation systems reliability and safety of complex systems; VDI/VDE 2000.)			
Speed	The magnitude of velocity, which is a vector	Bar-Shalom (2001)			
Statistical Inference	Seeks to draw conclusions about an underlying mechanism or distribution, based on an observed sample of data. A probabilistic model is assumed that involves one or more random variables having a defined (but unknown) probability distribution that provides a connection between observed data and a population.	David Hall (1992)			Specific categories of inference are described elsewhere
System	A collection of components organized to accomplish a specific function or set of functions.	EAST-EAA (IEEE Recommended Practice for Architectural Description of Software-Intensive Systems; IEEE Standard P1471, IEEE Architecture Working Group (AWG), 2000.)	Set of elements, which interact according to a design; an element of a system can be another system, called a subsystem, which may be controlling system or a controlled system and may include hardware, software and human interaction	Functional safety: safety instrumented systems for the process industry section; Part 1: Framework, definitions, system, hardware and software requirements; IEC2002.	
Track	A maintained time-sequence representation of the behavior of moving objects	David Hall (1992)	The output of a tracking process		

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Track array	A set of tracks coming from a sensor processing of a measurement scan				
Track fusion	see Information Fusion				The sources are sensor systems; their output consists of tracks
Track fusion	Fusion of track arrays				
Tracking	Is the estimation of the state of a moving object based on remote measurements. This is done using one or more sensors at fixed locations or on moving platforms.	Bar-Shalom (2001)			Moving object may be a relatively moving object (w.r.t. to ego-vehicle)