Innovative Neural Network Technology for DAIMON Decision Support System (DSS)

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Based on the estimated 50.000 tons of dumped chemical warfare agent (CWA) and more than 200.000 tons of conventional munition from the world wars I and II, there is a high risk that during this century toxic contents are released into the Baltic Sea. In case of an ammunition finding the Baltic Sea governments and companies have to make a case-to-case decision depending on the kind and status of the ammunition, the actual environmental conditions and the protection goods in the surrounding (e.g. humans, flora and fauna, infrastructure). To assess the process a decision support system based on innovative neural network technology was developed within the DAIMON project. The core of the innovative approach is that all relevant and highly heterogeneous information for decision-making is processed and stored in a similar way like the brain of vertebrates. As our research has shown, this organisation principle of the brain - called "Computing with Activities" - is unique in order to handle the heterogeneity of the data with its wide ranges and situation relevant weighting and is in addition, robust against natural, environmental fluctuations.

Key observations

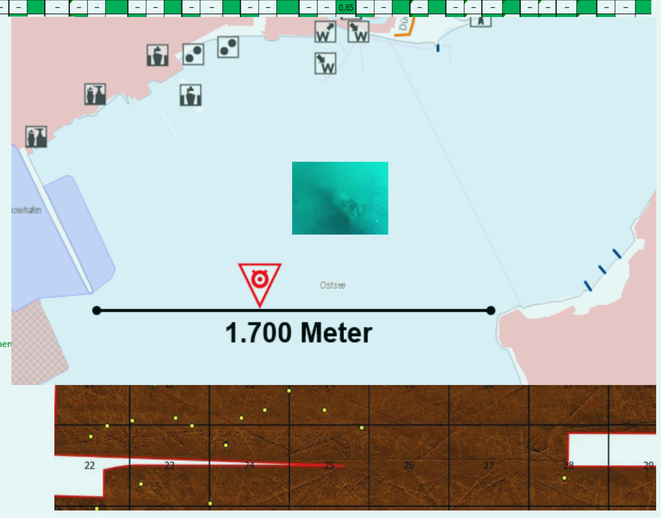
- Computing with Activities (CWA) enables neural networks to handle a wide range of heterogenious data.
- CWA enables the mapping of expert assessment.
- Combination of color-based CWA nets enables first time a dificient aspects categorisation of objects and environmental influences.

➡ Highly precise describtion of complex situations and derivation of recommendations for action

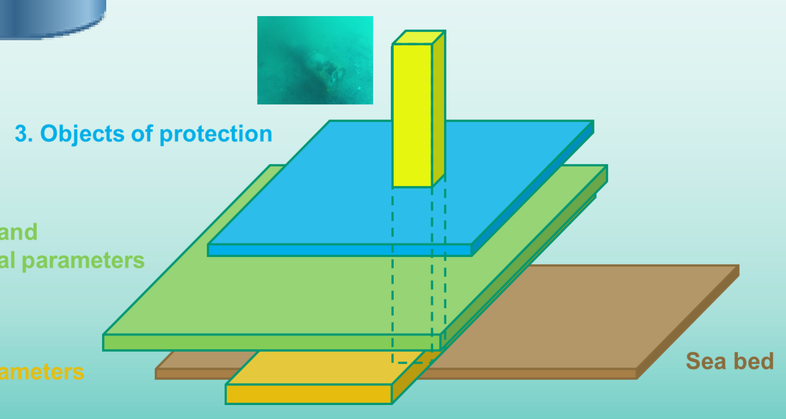
Data handling and storage

Sample code	Area	Sulphur mustard-related																												Adamsite-related		Clark I/II-related			
		1			1.1			1.1S			1.1O			1.1OS			1.2			1.20			1.3			1.4			1.5			1.6			1.7			1.7S			2O		2T			3O		3T		
		F	M	V	V	F	M	F	V	F	M	V	F	M	V	F	M	V	F	M	V	F	M	V	F	M	V	F	M	V	F	M	V	F	M	V	F	M	V	F	V	F	M	F	V	F	M	V
WH349/B09/1	Reference area				–	–	–		–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
WH349/B09/2	Reference area				–	–	–	–	–	–	–		610	–	–	–	–	–	–	–	–	120	–	–	19	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20	–
WH349/B09/3	Reference area				–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
WH349/B13/1	Bornholm dumpsite				–	–	–	–	–		–		–	–	12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17	–	–	–	–	–	25	–
WH349/B13/10	Bornholm dumpsite				–	–	–	–	–		–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0,65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

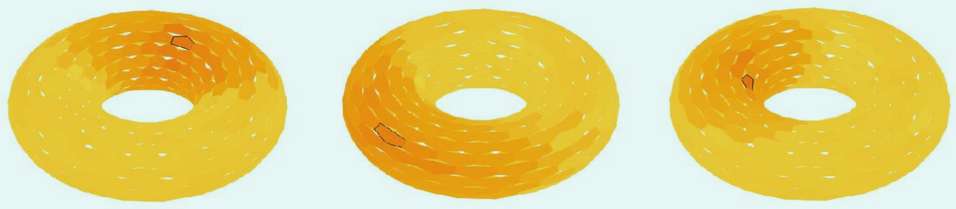
▼ description {8}
munition_id : 9
diameter : 370
total_length : 1650
total_weight : 250
detonating_charge : C/98 verk.
description : Body length about 1190 mm
shape_id : 1
shape_name : Cylindrical
▶ markings [2]
▶ explosive {5}
▶ fuses [1]
▼ chemical_agent {4}
munition_id : 9
chemical_agents_sub_groups_id : 12
weight : 100
chemical_agents_sub_group_name : α-Chloroacetophen



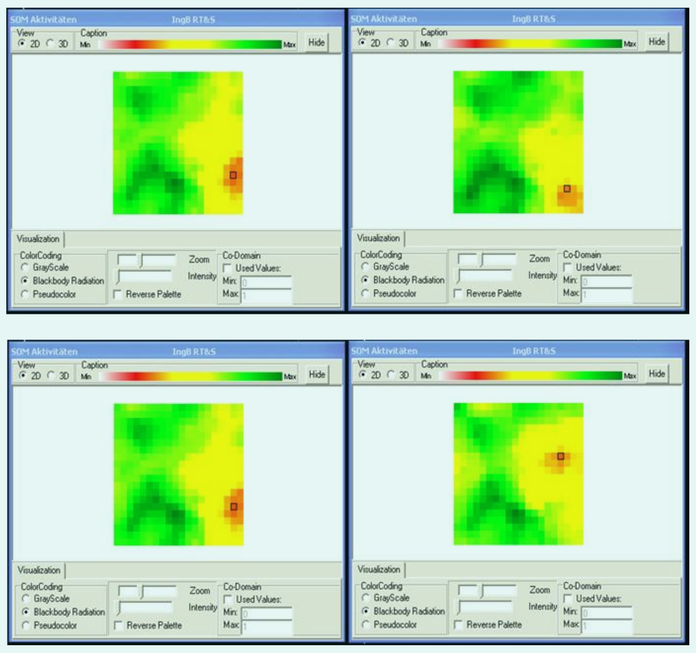
Storage of highly heterogenious object and environmental data in a database structure to calculate the case-to-case decision regarding to different objects of protection



Neural network structure

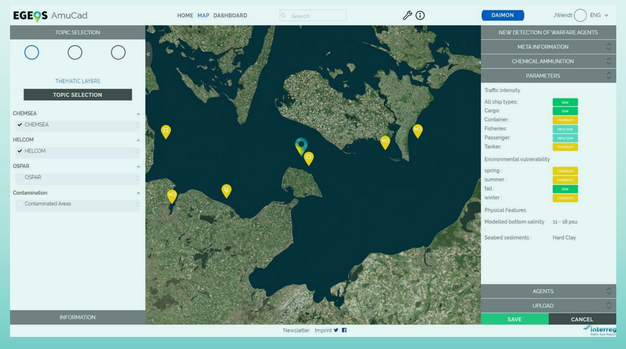


Different activity patterns reperent different interacting CWA moduls. Thus the Computing with Activities (CWA) aproach enables the neural net structure to process and store a wide range of variations in scenarios and can therefore differ between little changes in data to make a precise decision.



It is the CWA principle that garantees a robustness against natural fluctuations. For example: Changes in enrivonmental parameters do not fundamentally lead to a change in decision-making. In case of classical neural networks, where the decision is based on the activity of one winner neuron, this difference in the scenario could lead to different assessments. By means of CWA the information is stored in the entire activity of the net, so that small changes are detected, but do not lead to a completely different evaluation of the whole scenario.

Decision Support System



Results of the Decision support system (DSS): map and report