CLAIMS

[Claim 1] A method for scalable incremental weighted sampling, the method comprising:

compiling an input Boolean formula representing a space to be sampled from, to obtain an ordered binary decision diagram[∧] (OBDD[∧]);

parameterizing the obtained OBDD[∧] to obtain a probabilistic OBDD[∧] (PROB);

smoothing the obtained PROB by adding conjunction nodes to the obtained PROB; and

performing the weighted sampling from the smoothed PROB to obtain at least one assignment corresponding to a traversal through the smoothed PROB to a true node comprised in the smoothed PROB, while performing annotation of the smoothed PROB,

wherein the obtained at least one assignment corresponds to a suitable path for a transport task of a vehicle comprised in a transport system.

[Claim 2] The method of claim 1, wherein the parameterizing the obtained OBDD[∧] comprises determining a lo normalized weight of a false literal of an input Boolean variable associated with a decision in the input Boolean formula.

[Claim 3] The method of claim 2, wherein the parameterizing the obtained OBDD[∧] comprises determining a hi normalized weight of a true literal of the input Boolean variable associated with the decision in the input Boolean formula.

[Claim 4] The method of claim 3, wherein the lo normalized weight $\theta_{\mathrm{Lo}(n_d)}$ and the hi normalized weight $\theta_{\mathrm{Hi}(n_d)}$ are determined based on following equations:

$$\theta_{\mathsf{Lo}(n_d)} = \frac{W(\neg x_i)}{W(\neg x_i) + W(x_i)} \quad \theta_{\mathsf{Hi}(n_d)} = \frac{W(x_i)}{W(\neg x_i) + W(x_i)},$$

wherein *W*() is a weight function that returns a weight for an input Boolean variable, $\neg x_i$ is a false literal of an input Boolean variable x_i, and x_i is a true literal of the input Boolean variable x_i.

[Claim 5] The method of any one of claims 1 to 4, further comprising determining whether the obtained PROB is smooth,

wherein the smoothing the obtained PROB comprises, based on the obtained PROB being determined to not be smooth, smoothing the obtained PROB.

[Claim 6] The method of claim 5, wherein the obtained PROB is determined to not be smooth when a first variable set of a first child node for a decision node comprised in the PROB is different from a second variable set of a second child node for the decision node.

[Claim 7] The method of claim 6, wherein the smoothing the obtained PROB comprises replacing the first child node and the second child node of the decision node with the conjunction nodes, respectively.

[Claim 8] The method of claim 7, wherein the smoothing the obtained PROB further comprises setting the replaced first child node and the replaced second child node as child nodes of the conjunction nodes, respectively.

[Claim 9] The method of claim 8, wherein the smoothing the obtained PROB further comprises, for a missing variable of each of the conjunction nodes, setting a new decision node representing the missing variable of a respective one of the conjunction modes as a child node of the respective one of the conjunction nodes.

[Claim 10] The method of claim 9, wherein the smoothing the obtained PROB further comprises, for each of the conjunction nodes, setting both child nodes of the new decision node to a true node.

[Claim 11] The method of any one of claims 1 to 10, wherein the weighted sampling from the smoothed PROB and the annotation of the smoothed PROB are performed in a bottom-up pass of the smoothed PROB, starting at true and false nodes of the smoothed PROB and ending at a root node of the smoothed PROB.

[Claim 12] The method of any one of claims 1 to 11, wherein the performing the weighted sampling from the smoothed PROB comprises ignoring one or more false nodes comprised in the smoothed PROB.

[Claim 13] The method of any one of claims 1 to 12, wherein the performing the weighted sampling from the smoothed PROB comprises obtaining, as a portion of

the at least one assignment, a union of variables for child nodes of each conjunction node comprised in the smoothed PROB.

[Claim 14] The method of any one of claims 1 to 13, wherein the performing the weighted sampling from the smoothed PROB comprises obtaining, as a portion of the at least one assignment, a decision on a Boolean variable associated with each decision node comprised in the smoothed PROB.

[Claim 15] The method of claim 14, wherein the performing the annotation of the smoothed PROB comprises:

calculating, for each decision node, a lo joint probability of choosing a false literal of a Boolean variable, and a hi joint probability of choosing a true literal of the Boolean variable, the lo joint probability and the hi joint probability being weighted and being in a log space; and

calculating, for each decision node, a sum of the calculated lo joint probability and the calculated hi joint probability, using a LogSumExp function.

[Claim 16] The method of claim 15, wherein the performing the weighted sampling from the smoothed PROB further comprises determining the decision on the Boolean variable associated with each decision node, based on a binomial distribution that is calculated based on the calculated sum of the lo joint probability and the hi joint probability.

[Claim 17] The method of any one of claims 1 to 16, wherein ~~wherein the obtained at least one assignment corresponds to a suitable path for a transport task of a vehicle comprised in a transport system, and~~

the method further comprises controlling the transport system to perform the transport task along the suitable path.

[Claim 18] A server configured to perform the method of any one of claims 1 to 17.

[Claim 19] A computer program element comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 17.

[Claim 20] A computer-readable medium comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 17.