State of the Art This chapter will discuss the 3D LiDAR datasets available and classify them based on the type of
This section will discuss the available LiDAR datasets for the 3D semantic segmentation task and classify the datas

Static datasets are advantageous because they can produce highly dense point clouds leading to rich geometric repr
The last type of 3D LiDAR dataset is the synthetic dataset. As the name suggests, these datasets are generated fro
The datasets belonging to each acquisition type are summed up in Table ??. Most of the datasets from Table ?? a

[h!] 3D LiDAR datasets clas

acquisition mode	dataset	frames	points (in million)	classes	scene type
7*static	Oakland[?]	17	1.6	44	outdoor
	Paris-lille-3D[?]	3	143	50	outdoor
	Paris-rue-Madame[?]	2	20	17	outdoor
	S3DIS[?]	5	215	12	indoor
	ScanObjectNN[?]	-	-	15	indoor
	Semantic3D[?]	30	4009	8	outdoor
	TerraMobilita/IQmulus[?]	10	12	15	outdoor
	TUM City Campus[?]	631	41	8	outdoor
	DALES[?]	40 (tiles)	492	8	outdoor
7*sequential	A2D2[?]	41277	1238	38	outdoor
	AIO Drive[?]	100	-	23	outdoor
	KITTI-360[?]	100K	18000	19	outdoor
	nuScenes-lidarseg[?]	40000	1400	32	outdoor
	PandaSet[?]	16000	1844	37	outdoor
	SemanticKITTI[?]	43552	4549	28	outdoor
	SemanticPOSS[?]	2988	216	14	outdoor
	Sydney Urban[?]	631	-	26	outdoor
	Toronto-3D[?]	4	78.3	8	outdoor
1*synthetic	SynthCity[?]	75000	367.9	9	outdoor

We chose the Semantic3D dataset as the in-distribution (ID) training dataset from the available datasets. S3DIS is
3D semantic segmentation models
This section will discuss the methods available for 3D semantic segmentation. The discussion includes a brief peek
Traditional approach Traditional methods involve a complex features extraction and passing these features to a clas
Deep learning approach Deep learning based models are efficient at segmentation and can be divided into three typ
Let us look briefly into the point-based methods. Point-based methods majorly utilize fully connected layers or trac
The other flavours of point-based methods include projection onto a d-dimensional lattice or making the point clou
In projection-based models, let us discuss the models that project the data onto a 2D range image. The first of thi
We now discuss the projection-based models, which involve bird eye view projection. These models are relatively n
Table ?? illustrates the detailed summary of each model and the number of parameters. Finally, graph neural netw
Uncertainty estimation methods This section will discuss existing methods to estimate uncertainty in deep neural n
[?] argues that there are two kinds of uncertainties, they are epistemic and aleatoric uncertainty. Epistemic uncerta
Because of the higher computational complexity and resource intensiveness, there exist multiple flavours of the dee
Other methods include snapshot ensembles [?] which iterate over the multiple local optima in the optimization lan
Bayesian methods Existing neural networks are trained in maximum likelihood, resulting in point estimates for the

Here θ represents network parameters (weights), $p(\theta)$ represents prior distribution over θ, and x and y represent the inp

Here θ represents trained network parameters, x and y represent the training set, and x_t and y_t represent the test set.
VI is an approximation method where the posterior probability $p(\theta|x, y)$ is approximated by specific distributions r
Another widely known example for VI is Monte Carlo Dropout (MC-Dropout), in which the dropout layers are ref
Out-of-distribution (OOD) detection methods This section will discuss the existing OOD detection methods for 2D
The most widely used benchmark datasets used for 2D classification are CIFAR-10 vs SVHN [?], CIFAR-10 vs LSU

[?] has proposed a threshold-based OOD detection method using the Mahalanobis distance as a confidence score. The M

where $h(x)$ is final layer activations, c is the constant and $h^{-}(x)$ is ReAct output of $h(x)$. The score from this ReAct fu
TThe OOD data samples have higher uncertainty than ID samples, allowing us to use the uncertainty estimation m
In recent years, OOD detection for the task of 2D semantic segmentation has been getting into the limelight. [?] pr