Annexure A
Floor plan datasets ROBIN and S-ROBIN

Dataset plays a pivotal role in any image processing problem. Availability of a public dataset sometimes makes the life of a researcher easy. However, this is true for only generic problems, and not so for problems which are of some specific nature. Floor plan image analysis is such a problem where a large collection of samples is hardly available. For this reason two public datasets have already been proposed by researchers. They are: (i) SESYD [Delalandre *et al.*, 2010b] and (ii) CVC-FP [de las Heras *et al.*, 2015]. The former has 10 classes of floor plans, where there are 100 samples/class. The latter has 122 scanned floor plan documents divided into 4 categories based on the origin and style. The SESYD dataset is inappropriate for application to a retrieval task due to very less difference between a pair in a class of floor plan images. Also, in the CVC-FP dataset, the samples are insufficient in number for the task of floor plan retrieval.

To train and evaluate the contributions presented in this thesis, two floor plan databases, named Repository Of BuildIng floor plaNs (ROBIN) and Sketched-Repository Of BuildIng floor plaNs (S-ROBIN) are created. S-ROBIN are the sketch replicas of the ROBIN dataset containing floor plan images. These datasets have significantly aided in the content analysis and retrieval of similar floor plans as proposed in this thesis. The primary motivation while creating the ROBIN dataset was to have: i) sufficient number of sample to execute the experiments, and ii) variation (inter and intra class) among the samples. While searching for a dream house, the customer generally has the follwing sequence of requirements in his/her mind; i) the number of rooms inside the house, ii) the global shape of the house, iii) what is the pattern in which the rooms are connected to each other, and iv) if a user is looking for a well furnished home. then which furniture should be placed in the house and in which arrangement. In the following subsections, each of the points mentioned above are elaborated in detail.

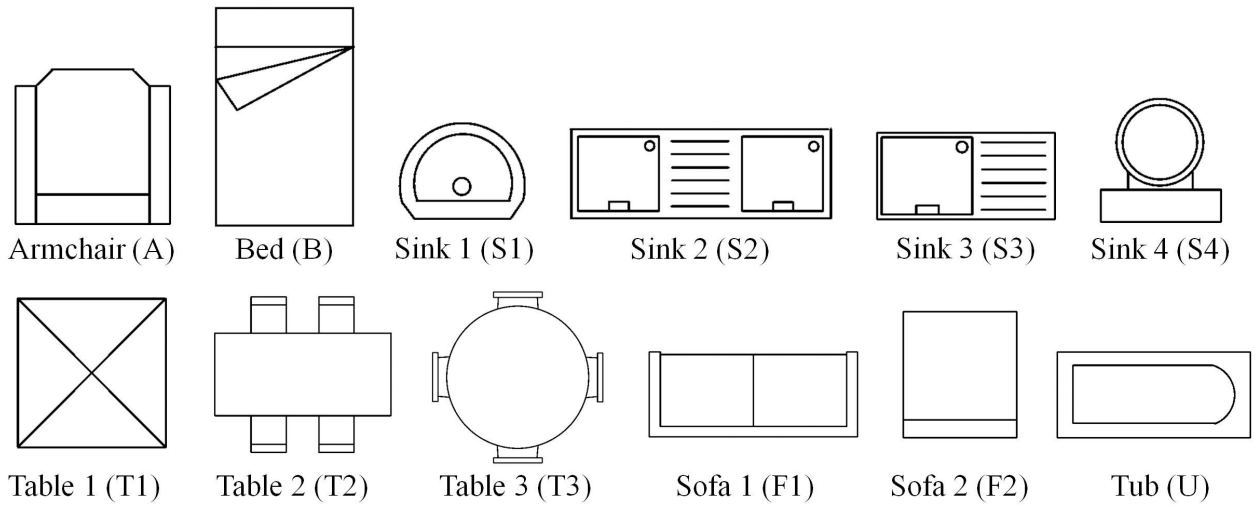

Figure A.1. : Symbol set used as furniture in ROBIN and S-ROBIN dataset.

A.1 NUMBER OF ROOMS

In ROBIN there are three categories of floor plans, depicting the three broad classes of houses. There are houses with 3, 4 and 5 rooms. The purpose and the subsequent label of each room varies depending on the various decors present in them. To be consistent with the existing floor plan datasets, the furniture symbols used in ROBIN dataset are similar to the ones used in SESYD dataset [Delalandre *et al.*, 2010a] as shown in Fig. A.1.

A.2 GLOBAL SHAPE OF THE HOUSE

The second important criteria kept in mind while designing the dataset was the global or overall shape of the layout. To design the floor plans the rooms were arranged either in the horizontal or the vertical direction with respect to each other. While designing, due consideration was given to the fact that, there is no arbitrary shaped floor plan image and also that curvilinear structures in the layout walls are avoided. Moreover, to increase the variability among the samples, difference in arrangement of rooms across 3, 4 and 5 room layout categories was also introduced. Figure A.2 (a), (b) and (c) depict the example of variation in global shapes across a layout category.

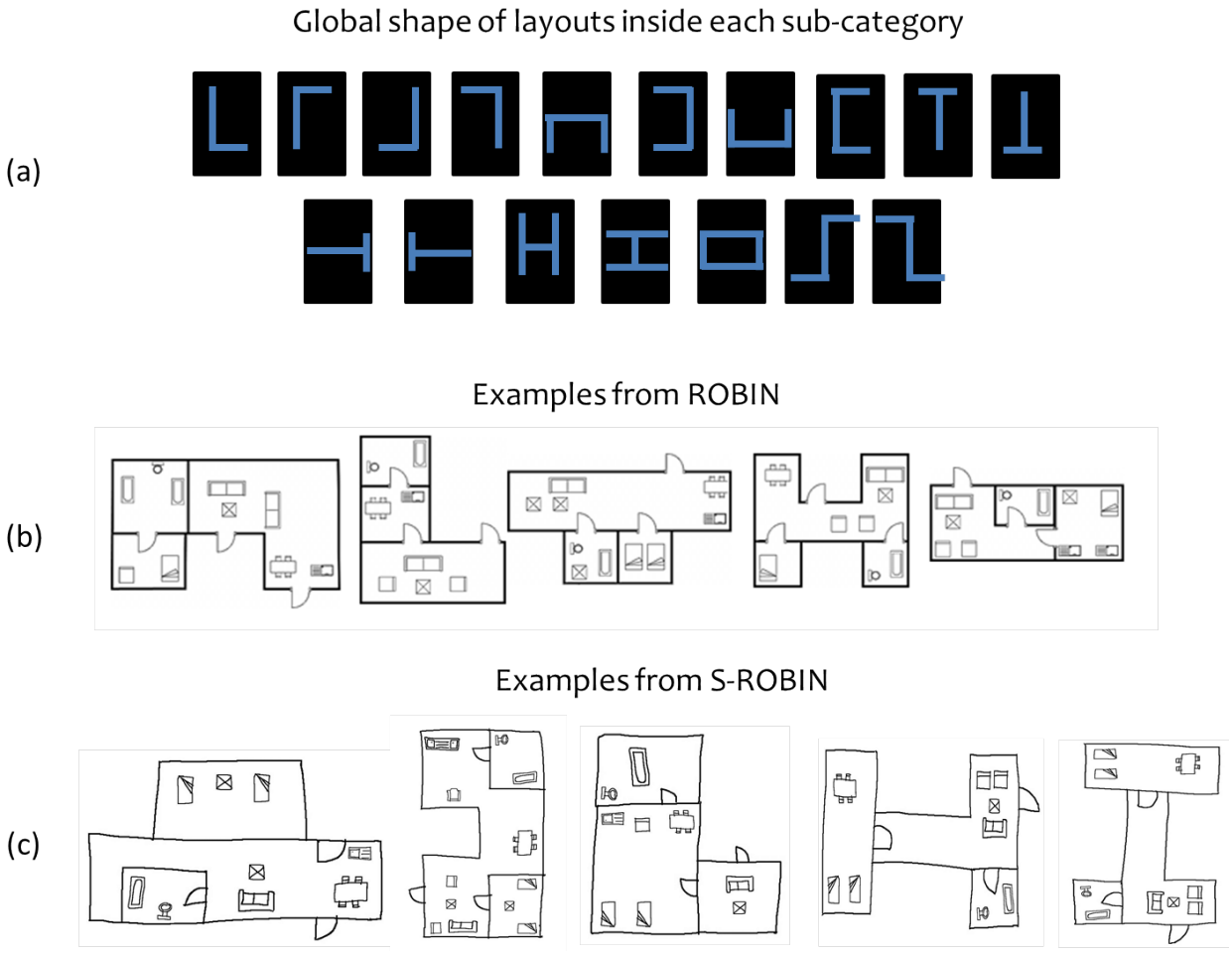

Figure A.2. : 3-Room layouts in the ROBIN and S-ROBIN dataset.

A.3 CONNECTIVITY WITHIN A HOUSE

Doors are placed at the desired places in the floor plans to ensure connectivity between the rooms. Orientation of each door is given special consideration to ensure proper direction of movement within the house. For every floor plan, there is atleast one door lying on the outer wall of the floor plan that opens inside the house and provides entry/exit for the house. Windows are appropriately placed on the walls of the floor plan to ensure proper ventilation and aesthetics. This makes the floor plan more realistic. Figure A.3 (b) can be observed for the arc-type door symbols satisfying entry-exit criteria in the floor plans.

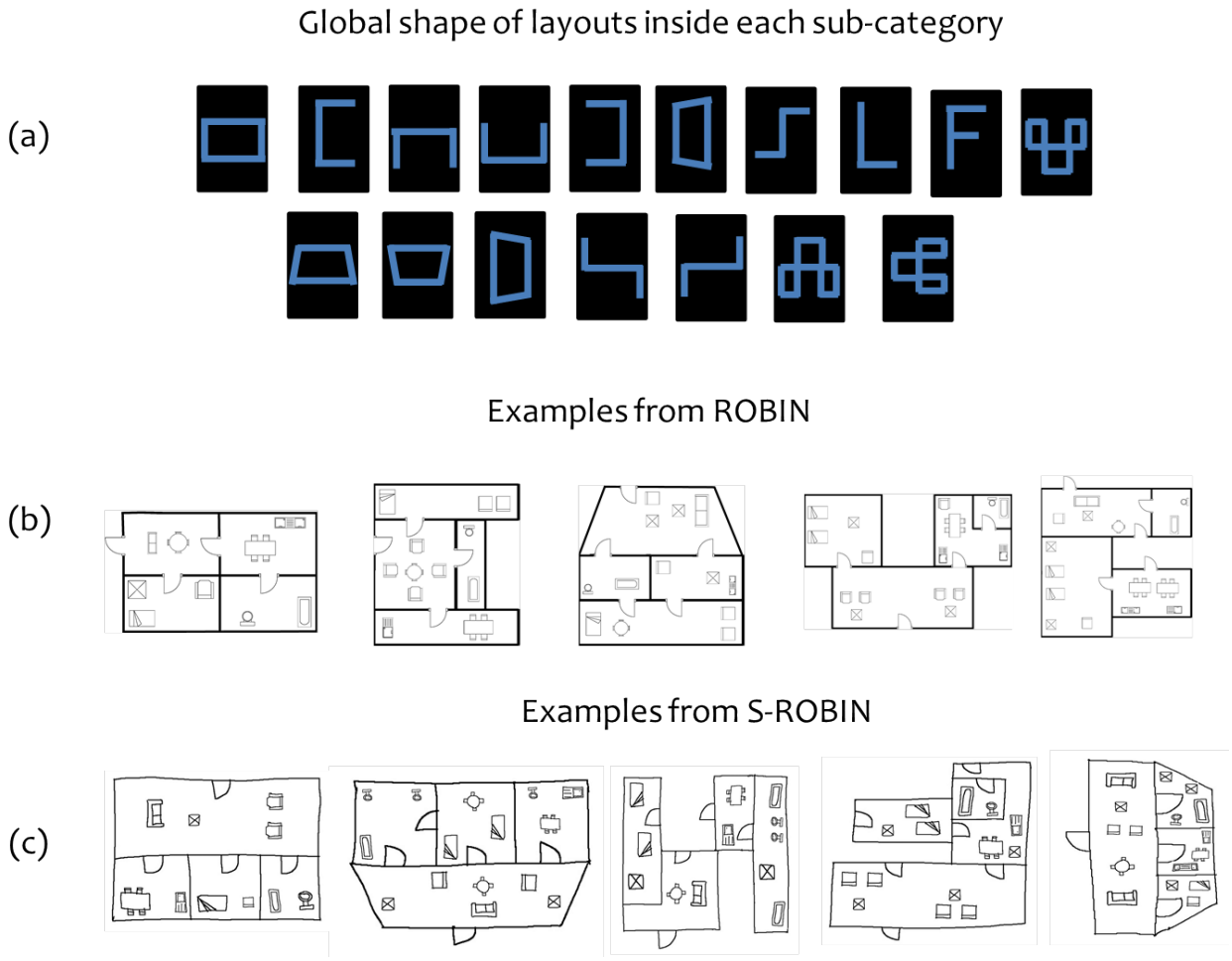

Figure A.3. : 4-Room layouts in the ROBIN and S-ROBIN dataset.

A.4 PLACEMENT OF FURNITURE

Furnitures or decors are inseparable part of a floor plan. To make the floor plans of ROBIN realistic, decor symbols as proposed by Delalandre *et al.* [2010a] were utilized. As shown in Fig. A.1, there are 12 different floor plan symbols. In each floor plan a subset of the entire symbol set was chosen and placed inside every room to give a definition to the room. As the furnitures are indicators of the purpose of the rooms, therefore, while designing, sufficient care has been taken to ensure that a house contains a i) kitchen, ii) bedroom, iv) washroom and a v) lobby. Moreover,

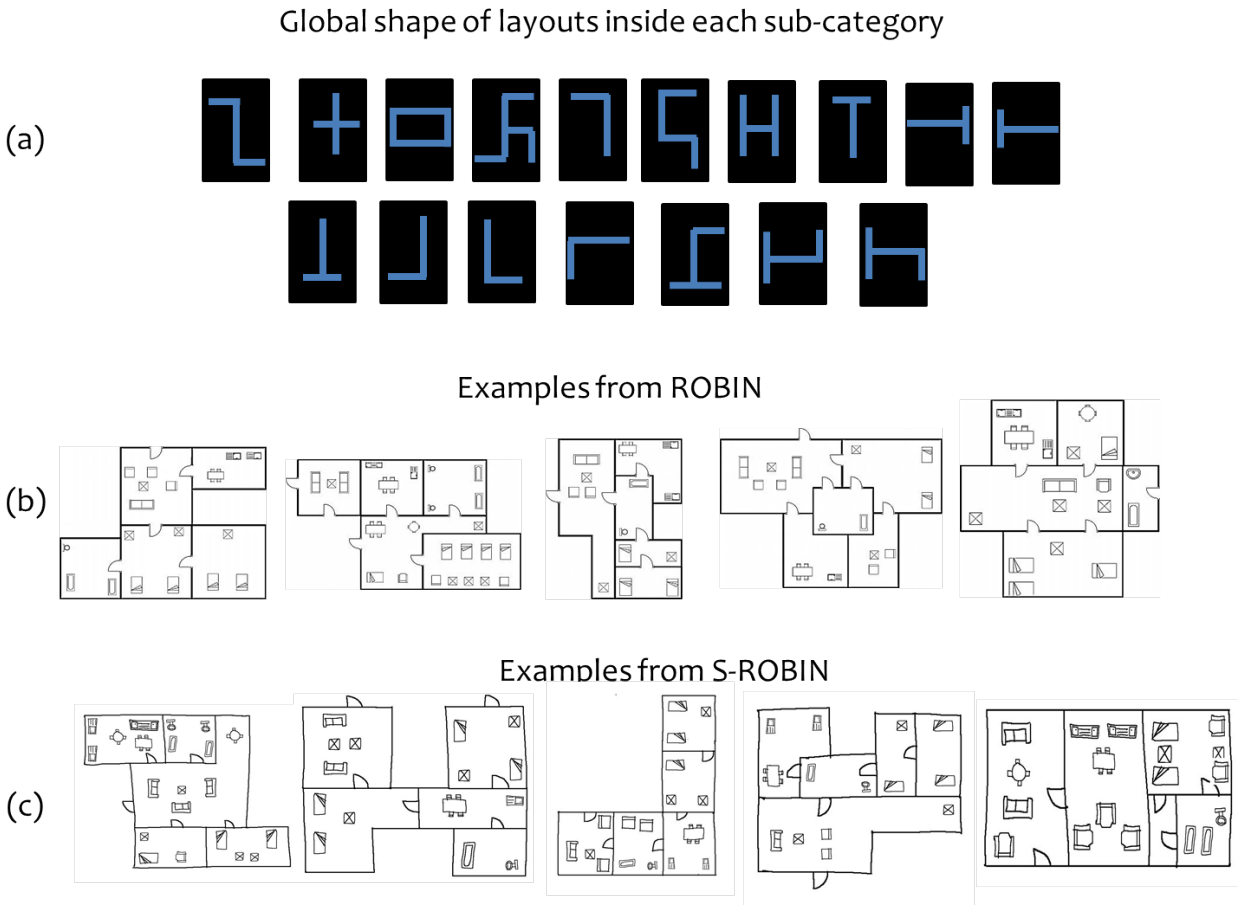

Figure A.4. : 5-Room layouts in the ROBIN and S-ROBIN dataset.

special consideration was given to the fact that the furniture is not placed in an arbitrary manner. For example, furniture should not be placed in a way that it blocks the door. Also, sufficient area should be left vacant after the furniture placement for navigation purposes.

A.5 DATASET CREATION PROCESS

ROBIN dataset was created on similar lines as the SESYD dataset [Delalandre *et al.*, 2010a]. Basic room structure of the floor plan was built using rectangular shape in Microsoft powerpoint. Thickness of each wall was kept uniform to be around 40 pixels. The decor symbols were inserted inside the rooms from the symbol library and door symbols were carefully placed on the room walls. On the other hand, to capture hand drawn sketched floor plans in S-ROBIN, volunteers were asked to draw the floor plans on a digital platform using a Wacom tablet. Wacom tablet is an interactive tool, where the user can draw on a board like tablet using a pen stylus conveniently and the resultant floor plan sketch is captured on the Microsoft paint software by adjusting the thickness of the strokes of the pen stylus. Since, offline mode is being used, the hand drawn floor plans are stored as an image and used for experimentation.

A.6 STATISTICS OF THE DATASET

Both the datasets contain 510 floor plans divided into 3 categories of layouts each with 17 sub categories. The unique characteristic of the datasets is that they are designed keeping in mind the need of a potential buyer. Every prospective buyer wants to have certain amenities and functionalities in their house. Thus, in the dataset, there are three broad categories, which are different from each other in terms of the number and type of rooms present in a floor plan. The broad categories are layouts with 3-rooms, 4-rooms and 5-rooms each which differ in the global shape of layout across their sub-categories. Each broad category is further classified into 17 sub-categories depending upon the global layout shape of the floor plan. Standard notations as mentioned by Delalandre *et al.* [2007], are followed for all the floor plans so that the datasets can be used for other floor plan analysis tasks as well, and not only for retrieval. The dataset has 12 different categories of furnitures inside each layout. These datasets help in better visualization of the floor plans and aid in efficient capturing of various high-level features while fine-grained retrieval. Illustrations of the various sub-categories in the floor plans and how their shapes are modeled are shown in Fig. A.2, Fig. A.3 and Fig. A.4. The size of the floor plans in ROBIN vary from 825×708 to 2916×1845 whereas the resolution in S-ROBIN dataset ranges from 591×517 pixels to 1483×884.

A.7 CONCLUSION

The rationale behind the creation of ROBIN and S-ROBIN dataset was to create a floor plan repository that can be used for research purposes by the Document Analysis and Retrieval (DAR) community. Both ROBIN and S-ROBIN dataset are sufficient for carrying out tasks like, retrieval, semantic segmentation, door to door navigation, etc. The entire dataset along with the annotations can be downloaded from [S-ROBIN, 2018].