

## Declaration

I hereby declare that the work presented in this Thesis titled *Content Based Analysis and Retrieval of Architectural Floor Plans* submitted to the Indian Institute of Technology Jodhpur in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy, is a bonafide record of the research work carried out under the supervision of Dr. Chiranjoy Chattopadhyay. The contents of this thesis in full or in parts, have not been submitted to, and will not be submitted by me to, any other Institute or University in India or abroad for the award of any degree or diploma.

*Divya Sharma*  
*P15VSS002*



## Certificate

This is to certify that the thesis titled *Content Based Analysis and Retrieval of Architectural Floor Plans*, submitted by *Divya Sharma (P15VSS002)* to the Indian Institute of Technology Jodhpur for the award of the degree of *Doctor of Philosophy*, is a bonafide record of the research work done by her under my supervision. To the best of my knowledge, the contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

*Chiranjoy Chattopadhyay*  
*Ph.D. Thesis Supervisor*



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## List of Symbols

$N$	Total number of samples in a dataset
$\mathcal{I}$	Input floor plan image
$\oplus$	Dilation
$\ominus$	Erosion
$S_a$	Structuring Element
$\mathcal{I}_w$	Input floor plan image without walls
$F$	Furniture template signature
$\mathcal{C}$	Furniture count
$\mathcal{T}$	Furniture type set
$\mathcal{B}$	Blobs obtained through morphological fill operation
$\mathbf{CC}()$	Connected Component Operator
$ \cdot $	Cardinality
$C$	Connected components of a blob
$\mathcal{A}$	Set containing areas of the connected components in a blob
$S()$	Signature
$G_k$	Topology graph representing adjacencies in $k^{th}$ floor plan
$V_k$	Vertex set of a graph representing $k^{th}$ floor plan
$E_k$	Edge set of a graph representing $k^{th}$ floor plan
$\lambda_k$	Eigen values
$\vec{\phi}_k$	Eigen vectors
$Adj_k$	Adjacency matrix of the $k^{th}$ graph
$\vec{F}_k$	Feature vector
$Cv$	Covariance Matrix
$cost_{qm}$	Match cost between two floor plan samples q and m
$\mathcal{C}^u$	Unique furniture inside each floor plan
$Ar$	Carpet Area of a room
$L_k$	$k^{th}$ layout
$ \cdot $	Absolute value of a function
$A(\cdot)$	Carpet Area Ratio of a room corresponding to a layout
$e(\cdot, \cdot)$	Edit Distance
$\rho(\cdot)$	Room adjacency string matching score
$\psi(\cdot)$	Carpet Area Ratio matching score
$\phi(\cdot)$	Difference in number of furniture
$\theta(\cdot)$	Difference in type of furniture
$F^+$	Cumulative match score of a feature be it $\theta, \psi, \phi, \rho$
$\eta$	Weight Coefficients
$I$	Image domain
$S$	Sketch domain
$f_I^i$	$i^{th}$ floor plan image sample
$f_S^j$	$j^{th}$ floor plan sketch sample from S-ROBIN
$\mathbf{F}(\cdot)$	Mapping function mapping images to sketches
$\mathbf{G}(\cdot)$	Mapping function mapping sketches to images
$D_S$	Adversarial Discriminator for sketches
$D_I$	Adversarial Discriminator for images

$f_S \rightarrow p(f_S)$	Probability distribution of a sample $f_S \in \mathcal{S}$
$f_I \rightarrow p(f_I)$	Probability distribution of a sample $f_I \in I$
$S2I_A(\cdot)$	Adversarial loss function for mapping a floor plan sketch to an image
$I2S_A(\cdot)$	Adversarial loss function for mapping a floor plan image to a sketch
$CCL(\cdot)$	Cycle consistency loss
$X(\cdot)$	Final objective function in Cycle GAN
$\alpha$	Hyperparameter in Cycle GAN network
$\mathcal{E}$	Encoder
$\mathcal{D}$	Decoder

## List of Abbreviations

<b>ARD</b>	Adjacent Room Detection
<b>ARG</b>	Attributed Relational Graphs
<b>CAD</b>	Computer Aided Design
<b>CAR</b>	Carpet Area Ratio
<b>CBIR</b>	Content Based Image Retrieval
<b>CMS</b>	Cumulative Match Score
<b>CNN</b>	Convolutional Neural Network
<b>CVC-FP</b>	Computer Vision Center- Floor Plan
<b>DAR</b>	Document Analysis and Retrieval
<b>DIA</b>	Document Image Analysis
<b>DNN</b>	Deep Neural Networks
<b>D-SIFT</b>	Dense Scale Invariant Feature Transform
<b>FCR</b>	Furniture Composition Record
<b>GAN</b>	Generative Adversarial Network
<b>GI</b>	Generated Images
<b>GS</b>	Generated Sketches
<b>GUI</b>	Graphical User Interface
<b>HOG</b>	Histogram of Gradients
<b>MAP</b>	Mean Average Precision
<b>OASIS</b>	Online Algorithm for Scalable Image Similarity
<b>PR</b>	Precision Recall
<b>RAS</b>	Room Adjacency String
<b>RDM</b>	Room Decor Matching
<b>ReLU</b>	Rectified Linear Unit
<b>RLH</b>	Run Length Histogram
<b>RLM</b>	Room Layout Matching
<b>ROBIN</b>	Repository Of Building plans
<b>SESYD</b>	Systems Evaluation SYnthetic Documents
<b>SIFT</b>	Scale Invariant Feature Transform
<b>SOA</b>	State of the Art
<b>S-ROBIN</b>	Sketched Repository Of Building plans

