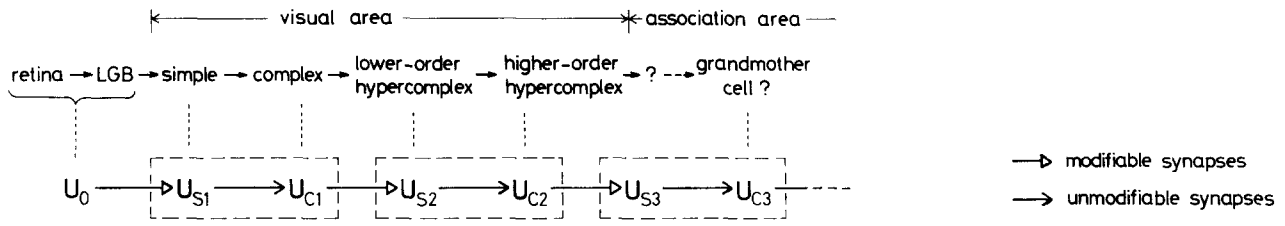


**Fig. 1.** Correspondence between the hierarchy model by Hubel and Wiesel, and the neural network of the neocognitron

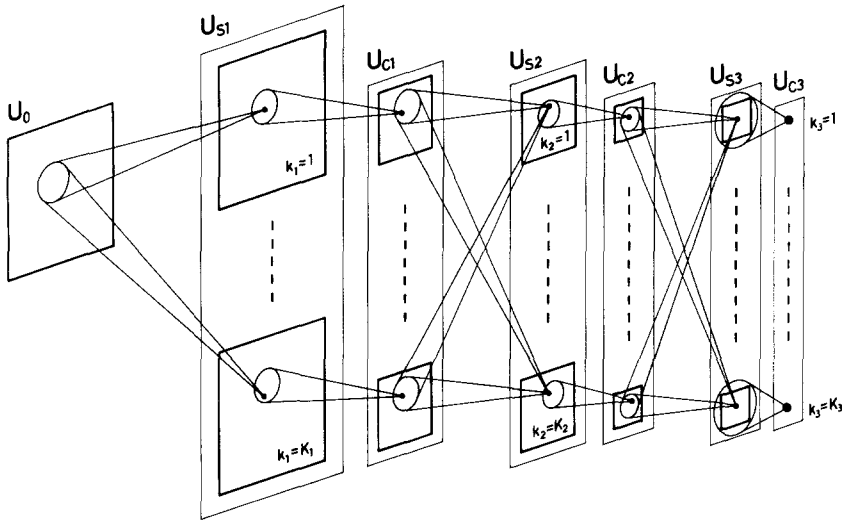


**Fig. 2.** Schematic diagram illustrating the interconnections between layers in the neocognitron

shifted in parallel from cell to cell. Hence, all the cells in a single cell-plane have receptive fields of the same function, but at different positions.

We will use notations $u_{Sl}(k_l, \mathbf{n})$ to represent the output of an S-cell in the $k_l$-th S-plane in the $l$-th module, and $u_{Cl}(k_l, \mathbf{n})$ to represent the output of a C-cell in the $k_l$-th C-plane in that module, where $\mathbf{n}$ is the two-dimensional co-ordinates representing the position of these cell's receptive fields in the input layer.

Figure 2 is a schematic diagram illustrating the interconnections between layers. Each tetragon drawn with heavy lines represents an S-plane or a C-plane, and each vertical tetragon drawn with thin lines, in which S-planes or C-planes are enclosed, represents an S-layer or a C-layer.

In Fig. 2, a cell of each layer receives afferent connections from the cells within the area enclosed by the elipse in its preceding layer. To be exact, as for the S-cells, the elipses in Fig. 2 does not show the *connecting* area but the *connectable* area to the S-cells. That is, all the interconnections coming from the elipses are not always formed, because the synaptic connections incoming to the S-cells have plasticity.

In Fig. 2, for the sake of simplicity of the figure, only one cell is shown in each cell-plane. In fact, all the cells in a cell-plane have input synapses of the same spatial distribution as shown in Fig. 3, and only the positions of the presynaptic cells are shifted in parallel from cell to cell.

Since the cells in the network are interconnected in a cascade as shown in Fig. 2, the deeper the layer is, the larger becomes the receptive field of each cell of that layer. The density of the cells in each cell-plane is so determined as to decrease in accordance with the increase of the size of the receptive fields. Hence, the total number of the cells in each cell-plane decreases with the depth of the cell-plane in the network. In the last module, the receptive field of each C-cell becomes so large as to cover the whole area of input layer $U_0$, and each C-plane is so determined as to have only one C-cell.

The S-cells and C-cells are excitatory cells. That is, all the efferent synapses from these cells are excitatory. Although it is not shown in Fig. 2, we also have

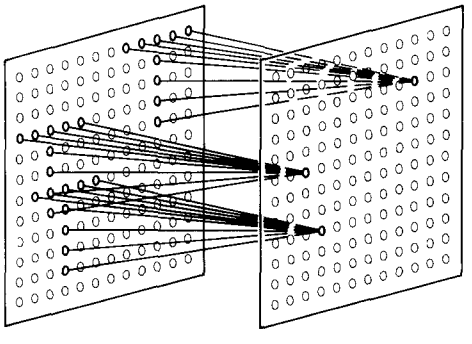

**Fig. 3.** Illustration showing the input interconnections to the cells within a single cell-plane