There have been identified two functionally different neuron classes in the primary visual cortex (V1), so-called simple and complex cells. These cells differ in reactions to various stimuli and their development has been successfully simulated in one computational model of V1. This model, however, simulates both classes in separate layers corresponding to layers 4C and 2/3 in V1. On the contrary, experiments have shown that both categories are – in different proportions – present in both layers. In this thesis, a computational model with a realistic distribution of complex and simple cells is presented. To increase its authenticity, I incorporate long-range excitatory and short-range inhibitory lateral cortical connections as found in animals, overcoming one drawback of previous models that used long-range inhibition. To assess my model, two measures of orientation selectivity – circular variance and orientation bandwidth – were computed for each simulated neuron. Using this measures, I compared my model with data from macaque monkey. In line with biological findings, my model develops a wide diversity of orientation selectivity. Moreover, it develops maps of orientation preference and realistic receptive fields.