Estimation method of optical flow is an effective method for analysis image sequences. However, there are important problems that have to be solved to precisely estimate optical flow such as occlusion, brightness change and fluid analysis using image sequences. As purpose of this research, in actual image sequences, I aim at solving these important problems in optical flow estimation. In order to solve the problems, I attempt to use velocity vector constraint equations for estimating velocity vectors, which mean "actual motions of objects", in each problem. In actual image sequence, there is a case that parameters including velocity vectors in the constraint equations are scattered in the parameter space, since differential coefficients of the parameters in the constraint equations are affected by noise and so on. In such the situation, we can not uniquely determine parameters of velocity vectors. In order to estimate the parameters of velocity vectors in such the situation, I use a voting process with a weighting function that is based on a non-liner approach to estimate parameters in the constraint equations. Since each problem has a particular problem, based on the voting method, I solve each problem by using each particular approach such as

·**Occlusion:** In estimating velocity vectors, in order to exclude effectiveness of constraint equations effected by noise and in occlusion regions, I use an method of optical flow estimation via voting process with a weighting function. To separate different motions in regions of different motions, in the voting process, I set a condition to separate constraint equations in different motions. In occlusion regions, there is a limit of precision of optical flow estimation by using the voting process with a weighting function. Thus, I use extrapolation of velocity vectors in occlusion regions from estimated velocity vectors in assigned regions of the occlusion regions.

·**Brightness change:** A velocity vector constraint equation considered brightness change includes three parameters such as velocity vector parameters and temporal change of intensity. In order to estimate the most likelihood parameter in a parameter space, I expand the parameter space to a 3-dimensional parameter space. I then estimate the parameters in the constraint equation by using a voting process with a weighting function in a 3-dimensional voting space.

·**Fluid analysis using image sequences:** In order to deal with the problem of fluid analysis using by image sequences as a problem of estimating of the most likelihood in a parameter space, I derive an optical flow constraint equation considering physical constraints of fluid. The constraint equation includes three parameters such as velocity vector parameters and spatial change of pressure. In order to estimate the most likelihood parameter in a parameter space, expand the parameter space to a 3-dimensional parameter space. I then estimate the parameters in the constraint equation by using a voting process with a weighting function in a 3-dimensional voting space.