On the blow-up results for a class of strongly perturbed semilinear heat equations

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We consider some class of strongly perturbed for the semilinear heat equation with Sobolev sub-critical power nonlinearity. We first derive a Lyapunov functional in similarity variables and then use it to derive the blow-up rate. Next we classify all possible asymptotic behaviors of the solution when it approaches to singularity, and describe precisely the blow-up profiles corresponding to these behaviors. Finally, we construct a solution which blows up in finite time with a given blow-up profile.