In this article, we propose a novel plasmonic mode converter based on embedded coding metamaterials to effectively convert the TE/TM mode in a silicon waveguide to the SPPs mode in a plasmonic waveguide. The simulation results exhibit that the converter can perform polarization-invariant mode conversion, and the conversion efficiency and bandwidth reach more than 0.93 and 200 nm, respectively. And the mode converter optimized by the optimization algorithms has three evident advantages: high conversion efficiency, wide bandwidth and polarization-independent input. Our proposed mode converter consists of a silicon waveguide, a plasmonic metal-dielectric-metal (MDM) waveguide and silicon-based coding metamaterials (SCM). All waveguides and SCM are placed on a silica substrate with the thickness of 3 μm. SCM is composed of *M*×*N* square pixels, each pixel can be selectively filled by silicon or air, corresponding to the logical “1” or “0” state, respectively. We use four optimization algorithms to design the SCM consisted of "0" and "1" respectively. In our simulation, the transmission spectrum of converter is calculated by the 2.5-dimensional finite-difference time-domain (FDTD) method (adopting Lumerical MODE Solutions). The conversion efficiency of transmission is defined as the ratio of the power coupled into the plasmonic waveguide and the output power of the silicon waveguide. We utilize direct-binary search (DBS) algorithm to design the SCM consisted of three different densities, which are 20x20, 30x30 and 40x40. Here, we should notice that in the traditional DBS, the algorithm will stop when it traverses all pixels in the SCM once; but in our paper, in order to further improve the algorithm searching ability, we propose a multi-traversal DBS (MDBS) to traverse the SCM several times in succession. Before the optimization, the maximums of the initial transmittances for three densities are lower than 0.20, indicating the converter is ineffective when the SCM is randomly initialized. After thousands of iterations to optimization, final transmission spectrums of three densities are above 75%, which implies that the MDBS is effective. The conversion efficiency of the converter consisted of 40x40 pixels can reach more than 93% in the bandwidth from 1450 nm to 1650 nm, which achieve the best result among three densities. For MDBS, we also research variation of loss for different iterations. In the initial iteration, the loss decreases rapidly, but with the increase of iteration times, the loss decreases more and more slowly, indicating that the algorithm is gradually convergent. In order to make a better comparison, for the SCM consisted of 40x40 pixels, we also use three other algorithms, including two evolutionary algorithms (particle swarm optimization (PSO) and genetic algorithm (GA)) and one search algorithm (simulated annealing (SA)) to design and optimize the converter. For GA and PSO, aiming to study the influence of parameter setting on the optimization results, we change different optimization parameters in the algorithm, such as the population size, crossover probability and mutation probability for GA or the velocity range and inertia weight for PSO. In order to ensure accuracy and rigor, we just change one single variable for different parameter groups to make compare. The best conversion efficiencies of the mode converter optimized by PSO, GA and SA are above 58%, 51% and 60% in the bandwidth from 1500nm to 1600nm, respectively. Obviously, these three algorithms are not as effective as MDBS no matter in terms of conversion efficiency or the bandwidth. In addition, the convergence speed of MDBS is the fastest in all optimization algorithms. Compared with the previous results, we not only propose a high-performance mode converter but also introduce an efficient algorithm for inverse design of SCM.