In this paper we numerically study supercontinuum generation by pumping a silicon nitride waveguide, with two zero-dispersion wavelengths, with femtosecond pulses. The waveguide dispersion is designed so that the pump pulse is in the normal-dispersion regime. We show that because of self-phase modulation, the initial pulse broadens into the anomalous-dispersion regime, which is sandwiched between the two normal-dispersion regimes, and here a soliton is formed. The interaction of the soliton and the broadened pulse in the normal-dispersion regime causes additional spectral broadening through formation of dispersive waves by non-degenerate four-wave mixing and cross-phase modulation. This broadening occurs mainly towards the second normal-dispersion regime. We show that pumping in either normal-dispersion regime allows broadening towards the other normal-dispersion regime. This ability to steer the continuum extension towards the direction of the other normal-dispersion regime beyond the sandwiched anomalous-dispersion regime underlies the directional supercontinuum notation. We numerically confirm the approach in a standard silica microstructured fiber geometry with two zero-dispersion wavelengths.