Visualizing transient events in the durations of their occurrences (i.e., real time) is indispensable to understanding many physical, chemical, and biological processes. Among existing methods, real-time ultrafast imaging based on coded optical streaking has received increasing attention because of its high image quality, high adaptability, and broad applicability. In this talk, I will review the working principles and limitations in representative ultrafast imaging modalities. Then, I will focus the discussion on three research directions in my Laboratory of Applied Computational Imaging in the past three years. First, I will present compressed optical-streaking ultrahigh-speed photography for the advanced characterization of rare-earth-doped nanoparticles for biomedical and information security applications [Nat. Commun. 12, 6401 (2021); Adv. Sci. 11, 2305284 (2024)]. Second, I will discuss how coded optical double-streaking can speed up single-pixel imaging to 12,000 frames per second [Nat. Commun. 13, 7879 (2022)] and coded-aperture temporal imaging to >100 trillion frames per second [Nat. Commun. 15, 1589 (2024)]. Finally, I will show how the dynamic optical diffraction, generated by the microsecond transition between two masks loaded onto a programmable grating, can be used as a new gating mechanism for ultrafast mapping photography [Optica 10, 1223 (2023)].