**Supporting Information for:**

Gate-controlled neuromodulatory optical synaptic transistor for adaptive learning and energy-accuracy balance

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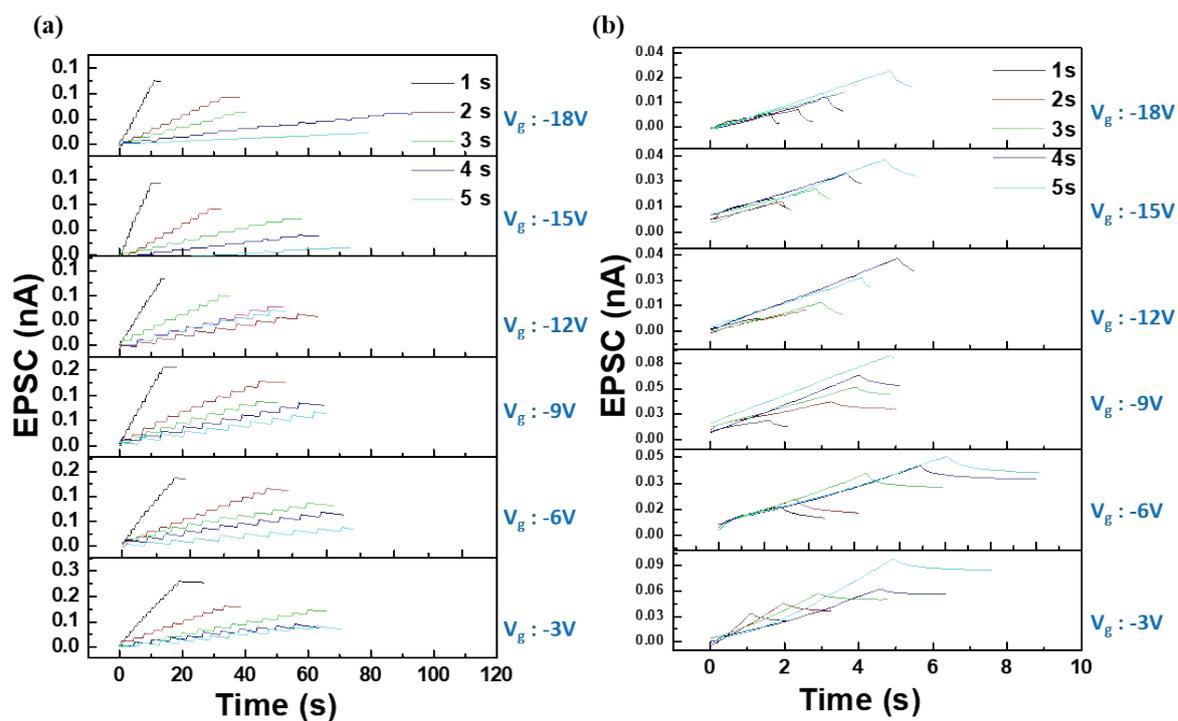
Keywords

Synaptic transistor, IGZO, Machine learning, Neuromodulation, CNN, Cifar-10
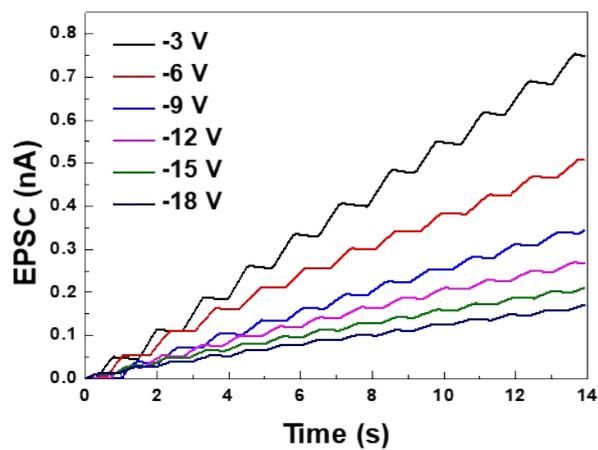
(a)

(b)
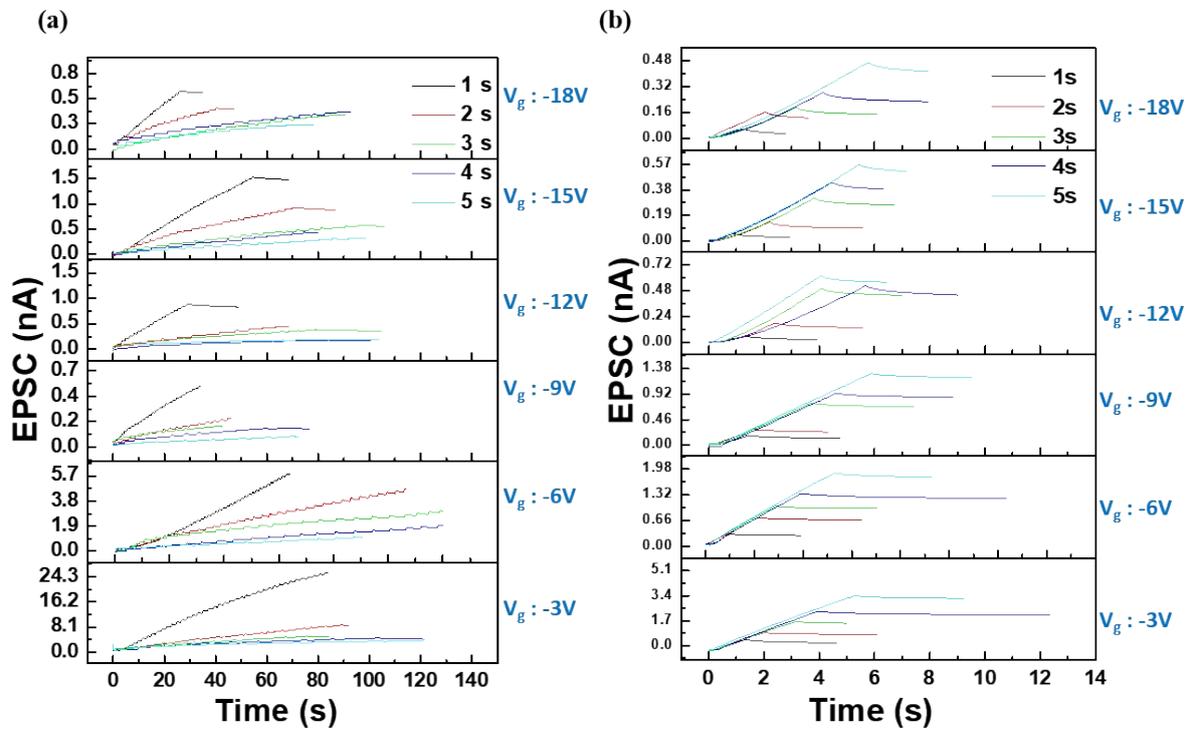
Figure S1. (a) EPSC responses under 450 nm blue light as a function of pulse interval across various gate voltages (–3 V to –18 V). (b) EPSC variations under 450 nm blue light as a

function of pulse duration under 450 nm illumination at different gate voltages (–3 V to –18 V).
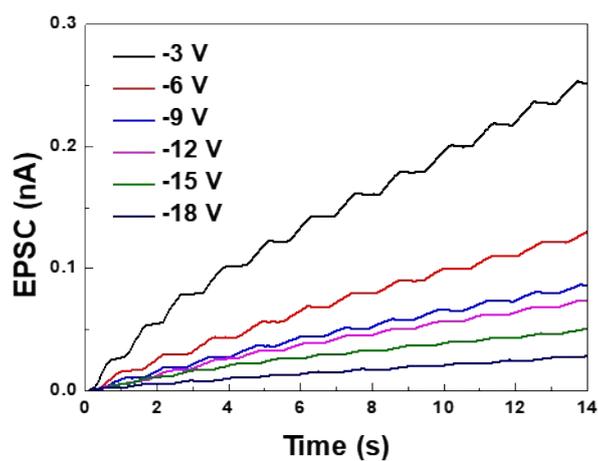
(a)

(b)

Figure S2. (a) EPSC responses under 520 nm green light as a function of pulse interval across various gate voltages (–3 V to –18 V). (b) EPSC variations under 520 nm green light as a function of pulse duration under 520 nm illumination at different gate voltages (–3 V to –18 V).

(a)

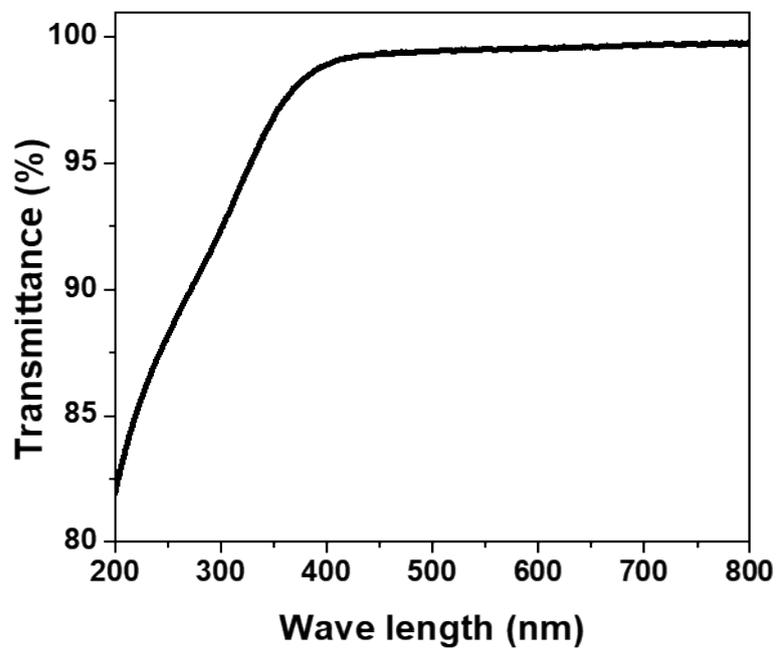**(b)**

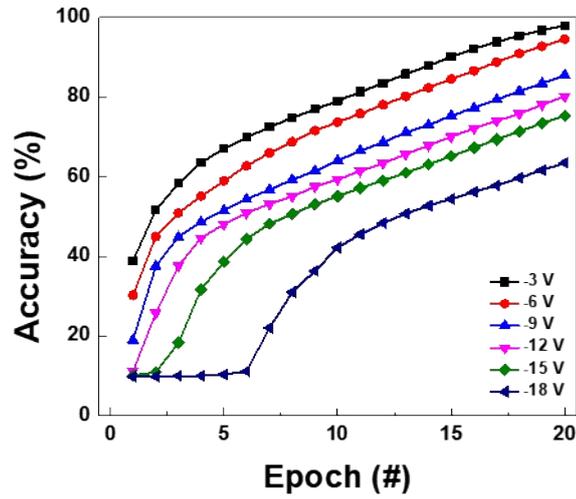
Figure S3. (a) EPSC responses under 450 nm blue light at various gate voltages (–3 V to –18 V). (b) EPSC responses under 520 nm green light at different gate voltages (–3 V to –18 V).
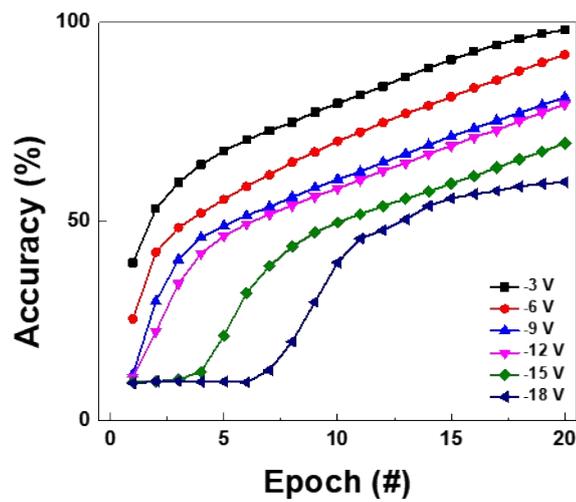
(a)

Figure S4. (a) UV–visible transmittance spectrum of the IGZO thin film, measured in the wavelength range of 300–800 nm.
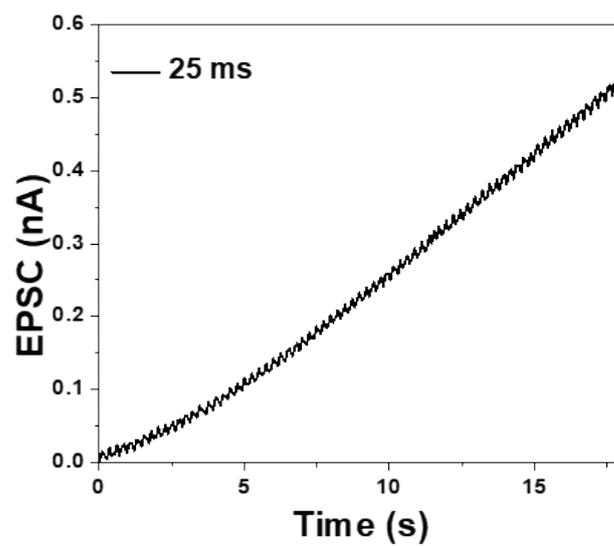
(a)

(b)

Figure S5. Classification accuracy on the CIFAR-10 dataset as a function of training epoch using a CNN architecture. (a) Model trained using synaptic weights derived from EPSC values under 405 nm blue light at various gate voltages. (b) Model trained using EPSC responses under 520 nm green light.
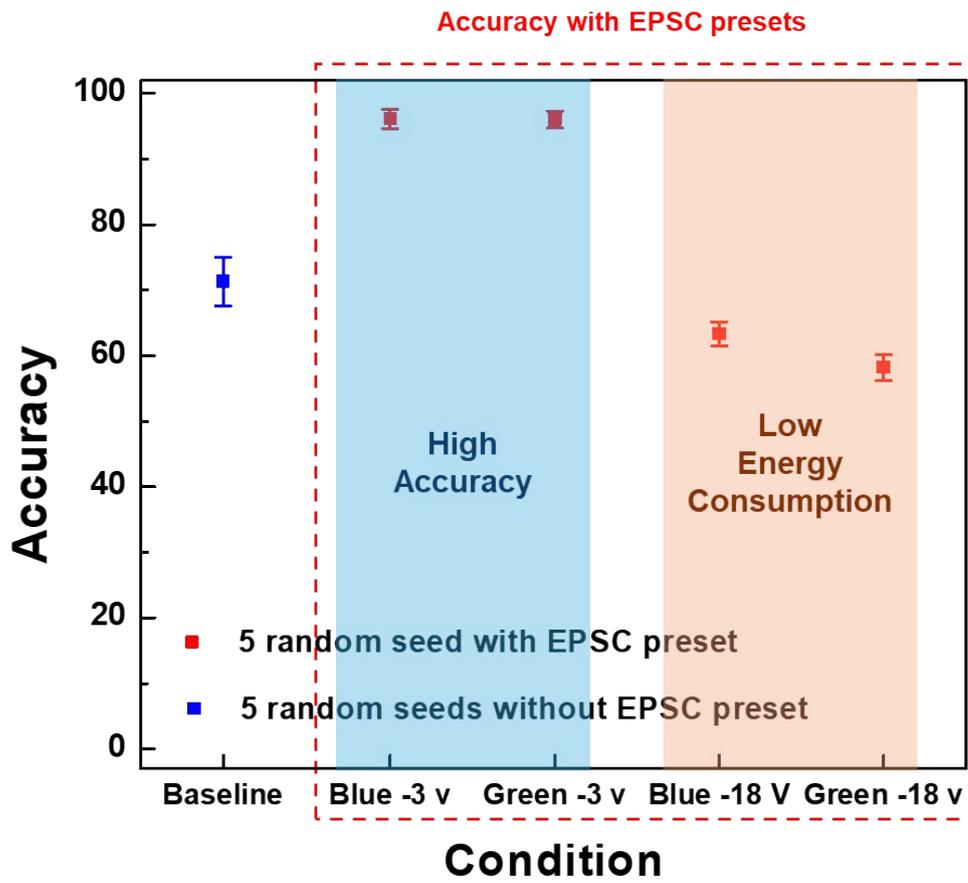
(a)

Figure S6. EPSC response of the device under periodic blue light pulses with a 25 ms interval
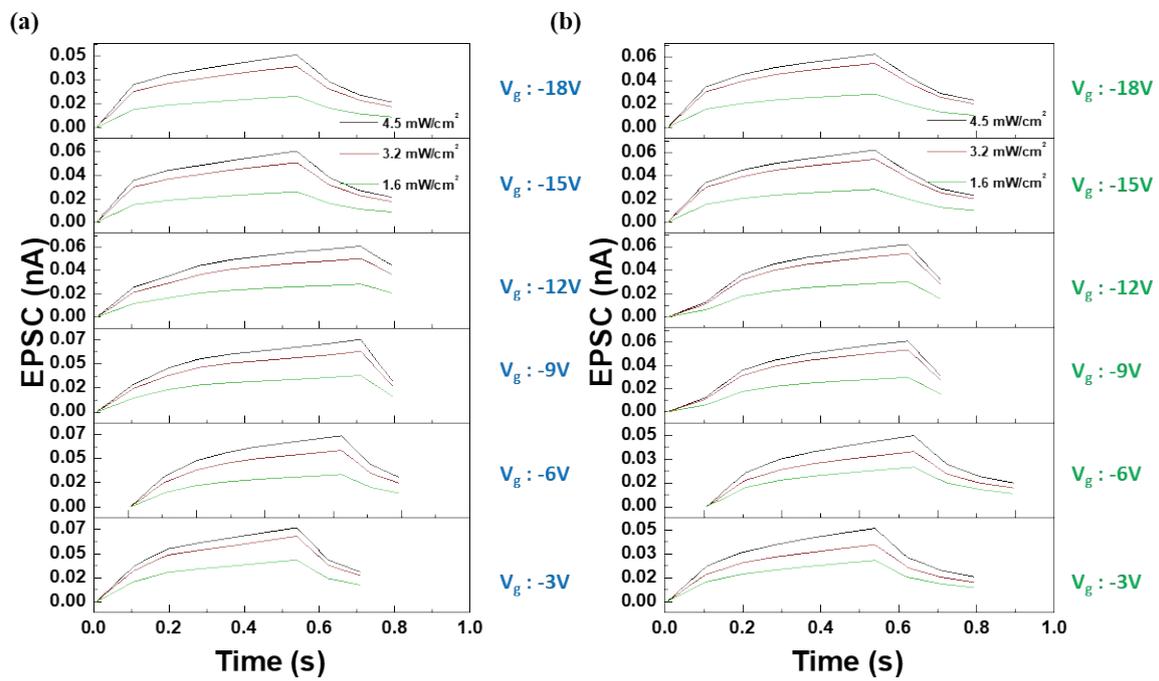
Figure S7. EPSC responses of the device under (a) blue(450 nm) and (b) green (520 nm)light at different gate voltages, depending on the input light intensity.

Figure S8. CNN accuracy distributions from five independent runs with different random seeds under baseline and EPSC-modulated conditions.