Detailed experimental procedures:

**Slice preparation** Experiments were performed using slices of somatosensory cortex taken from 28 day-old Wistar rats. Animals were anesthetized with halothane and decapitated in accordance with institutional and national guidelines. The brain was quickly removed and placed into cold (~4°C), oxygenated physiological solution containing (mM): NaCl 125, KCl 2.5, NaH₂PO₄ 1.25, NaHCO₃ glucose 25, MgCl₂ 1 and CaCl₂ 2, at pH 7.4. Sagittal or coronal slices (300 µm thick) were cut using a microslicer (Dosaka, Japan) and then transferred to oxygenated physiological solution and kept at 34°C. The recording chamber was perfused with warmed and oxygenated physiological solution of the above composition at 32–35°C.

**Electrophysiology** Somatic and dendritic patch-clamp recordings were made from layer 5 pyramidal neurons using infrared illumination combined with differential interference contrast optics. Recording pipettes (5-7 MΩ) were filled with intracellular solution containing (mM): K gluconate 105, Heps 10, MgCl₂ 2, MgATP₂ 2, sodium phosphocreatine 10, GTP 0.3 and KCl 30, with 2 mg/ml biocytin, at pH 7.3. Whole-cell recordings were made with Axoclamp-2B amplifiers (Axon Instruments, Foster City, CA, USA). Data were filtered at 3-5 kHz and acquired at 20-50 kHz using an Instrutech ITC-18 interface in conjunction with Axograph software (Axon Instruments). To generate “background” synaptic input, white noise was convolved with an exponential decay with a time constant of 1 ms. The variance and amplitude of this background current were adjusted during the experiment to give a spike rate of ~10 spikes/s with a CV ~1. Data were analyzed using custom macros written for IGOR Pro (Wavemetrics), Matlab (Mathworks) and the CTW algorithm (see below). Excitatory postsynaptic potentials were evoked via extracellular stimulation (0.2 ms, 5-50 V) using a patch pipette filled with extracellular solution placed within cortical layers 2/3, within 100 µm from the neuron being recorded from. Sweeps with background current alone (60 s) were alternated with sweeps where the identical background current was applied together with the evoked synaptic input (activated using a Poisson train at 10 spikes/s mean rate). The size of the synaptic input was monitored periodically using a 10 Hz train applied in the absence of background input.

**Histology** At the end of recording, the patch pipette was withdrawn to form an outside-out patch. Slices were then fixed by immersion in cold 4 paraformaldehyde in 0.1 M phosphate buffer, and afterwards processed with the avidin-biotin-peroxidase method to reveal the neuronal morphology. Reconstructions were performed with the aid of the Neurolucida computerized reconstruction system (MicroBrightField, Colchester, VT).