New program NeuroInfo allows for automatic delineation of mouse brains

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Video Abstract

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Abstract

Reproducibility is extremely important in science. But no matter how much effort is put into standardizing protocols, small differences seem inevitable in the way experiments are performed among laboratories. These small differences can add up to discrepancies that complicate data interpretation. One field where this issue looms large is neuroscience – particularly in experiments involving histological sections of the mouse brain. Such studies require correct identification of specific brain regions for accurate interpretation of results. But the mouse brain is small and complex. Brain atlases can be invaluable in mapping, but applying this information in laboratory experiments is difficult. A new automated system aims to solve this problem by taking the guesswork – and potential observer error and bias – out of the equation. Much like a GPS system in a car, the program – called NeuroInfo – helps researchers navigate through the microscopic anatomy of a brain section. This is achieved through the automatic registration of a digital image of an experimental brain section with a 3D digital brain atlas based on the Allen Mouse Brain Common Coordinate Framework. NeuroInfo uses this registration to retrieve anatomic region specifications from the atlas. This information is then superimposed onto the image of the experimental section. To validate NeuroInfo's performance, the software was used to register and delineate 60 experimental coronal sections from 12 different mouse brains. The sections were generated in two different laboratories and imaged with either fluorescence or brightfield microscopy. Anatomic regions delineated by the software were compared to delineations drawn by expert neuroanatomists. The results showed that the technology performed remarkably well in accurately delineating regions that are large and/or located in the dorsal parts of the brain – regardless of who prepared the samples or what type of microscopy was used. Importantly, identification took only a couple of minutes, while traditional methods could require up to a day to accomplish the same task. Areas located in the middle brain or those lacking nerve cells were more difficult to define, but it does appear that the approach has the power to fundamentally change how researchers investigate the mouse brain.