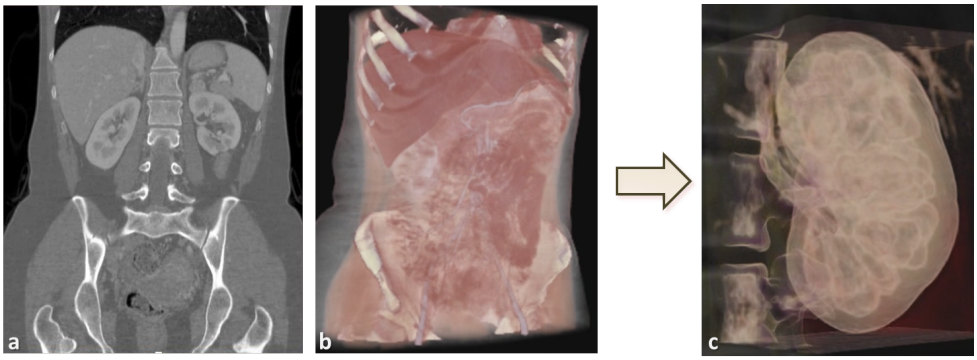

Fig. 4.11: **Automatic localization of anatomy in 3D Computed Tomography images. (a)** A coronal slice (frontal view) from a test 3D CT patient's scan. **(b)** Volumetric rendering of the scan to aid visualization. **(c)** Automatically localized left kidney using regression forest. Simultaneous localization of 25 different anatomical structures takes $\sim 4s$ on a single core of a standard desktop machine, with a localization accuracy of ~ 1.5cm. See [24] for algorithmic details.

focus on a single organ of interest.[4]

The continuous nature of the output suggests casting this task as a regression problem. Inspired by the work in [33] here we allow each voxel to vote (probabilistically) for the positions of all six walls. So, during testing, each voxel $\mathbf{p}$ in a CT image votes for where it thinks *e.g.* the left kidney should be. The votes take the form of relative displacement vectors

$$\mathbf{d}(\mathbf{p}) = \left(d^{\mathtt{L}}(\mathbf{p}), d^{\mathtt{R}}(\mathbf{p}), d^{\mathtt{A}}(\mathbf{p}), d^{\mathtt{P}}(\mathbf{p}), d^{\mathtt{H}}(\mathbf{p}), d^{\mathtt{F}}(\mathbf{p})\right) \in \mathbb{R}^6$$

(see fig. 4.12b). The $\mathtt{L}, \mathtt{R}, \mathtt{A}, \mathtt{P}, \mathtt{H}, \mathtt{F}$ symbols are conventional radiological notation and indicate the left, right, anterior, posterior, head and foot directions of the 3D volumetric scan. Some voxels have more influence (because associated with more confident localization predictions) and some less influence on the final prediction. The voxels relative weights are estimated probabilistically via a regression forest.

[4] A more general parametrization is given in [24].