Tissue diagnosis is an important part of modern day medicine. Where disease is suspected, tissue samples can be taken from the patient and viewed under the microscope by a Pathologist. In many human tissues, cells are organized into complex anatomical units called glands. In many disease states the glands are disrupted, often in a characteristic fashion. If automated image analysis is to be used to facilitate tissue diagnosis, then recognition of glands is essential.

A typical microscopic image of the human colon and the glands contained in it are shown in Fig.1. It can be seen there that a gland is composed of a group of cells who sit side-by-side and form the boundaries. Depending on the way the tissue has been sectioned, the shape of a gland can vary hugely and this poses significant challenge to computational algorithms for automatic gland detection.

To detect the gland contours in the polar image, we developed a Conditional Random Field (CRF) model [2]. We assign each row of the polar image a label $Y_i$, which indicates the position of the gland contour at each row. The graphical model of our CRF contains only 360 nodes in total and is illustrated in Fig.3.

This graph structure is a loop structure only if it contains one more edge which links $Y_1$ and $Y_{360}$, otherwise it will be a chain. To avoid the influence of this extra edge, we use two chain structures to approximate this circulate graph, thus enabling efficient inference. This is shown in Fig.4.

We treat the above random field model as a gland proposal module, and then develop another visual feature based support vector regressor (SVR) to verify if the inferred contour corresponds to a true gland. Finally, we combine [1] the outputs of the random field and the regressor to form the GlandVision algorithm for the detection of glandular structures. The flowchart of our complete GlandVision algorithm is depicted in Fig.5.

Experiments on a dataset of 20 high resolution microscopic images containing 1072 glands have shown the effectiveness of our approach.
