2D/3D registration is a key technology in image guidance because it facilitates fusion of 2D X-ray images with 3D pre/intraoperative images. Several methods have been presented in literature. Here we describe a possible improvement of image guidance during TACE procedure using 3D rotational angiography (3DRA) and 2D X-rays. The idea is to extract the catheter in the 2D X-rays, extract blood vessels in the 3DRA and then fuse 2D/3D using the knowledge that the catheter is inside the blood vessels.

### TACE overview

Transcatheter Arterial ChemoEmbolization is a minimal invasive procedure to treat liver cancer (Hepatocellular Carcinoma). The goal is to kill/stop the growth of tumors. First, a catheter is introduced into the hepatic artery via the femoral artery. Then, the interventionist navigates it to the artery that feeds the tumor. Next, he injects chemotherapeutic agents to kill the tumor and then emboli (beads) to cut off the blood supply. Currently interventionists guide the catheter using 2D X-rays (fluoroscopy) where they can see only the catheter. Frequently, angiographies (2D X-rays with contrast agent injection) are acquired to visualize the arteries. The difficulties of this intervention are the 2d navigation, patient/breathing motion, and the inability to continuously visualize the catheter position in the arteries.

### T2/3DRA registration

In abdominal catheterization, most proposed methods do 2D/3D registration with 2D intraoperative angiography and 3D preoperative CTA [1]. Then, the registration is used for the guidewire navigation helped with a breathing model and a partial catheter detection (the tip for example [2]). Here, we get an intraoperative 3DRA at the beginning of the procedure. And, we register it with 2D intraoperative X-rays (fluoroscopy). 3DRA has several advantages: 1) the contrast agent is injected directly in the arteries via the catheter so they are better visible compared to CTA; 2) the acquisition is done during the procedure, thus less deformation is expected during registration. The method steps are as follows. First, blood vessels are extracted from the 3DRA. Second, the catheter is extracted in real-time from the current fluoroscopy. Finally, the registration will be performed using back-projection of the extracted 2D catheter shape. This work is still in progress.

### References