Towards a Simple Framework of Skill Transfer Learning for Robotic Ultrasound-guidance Procedures

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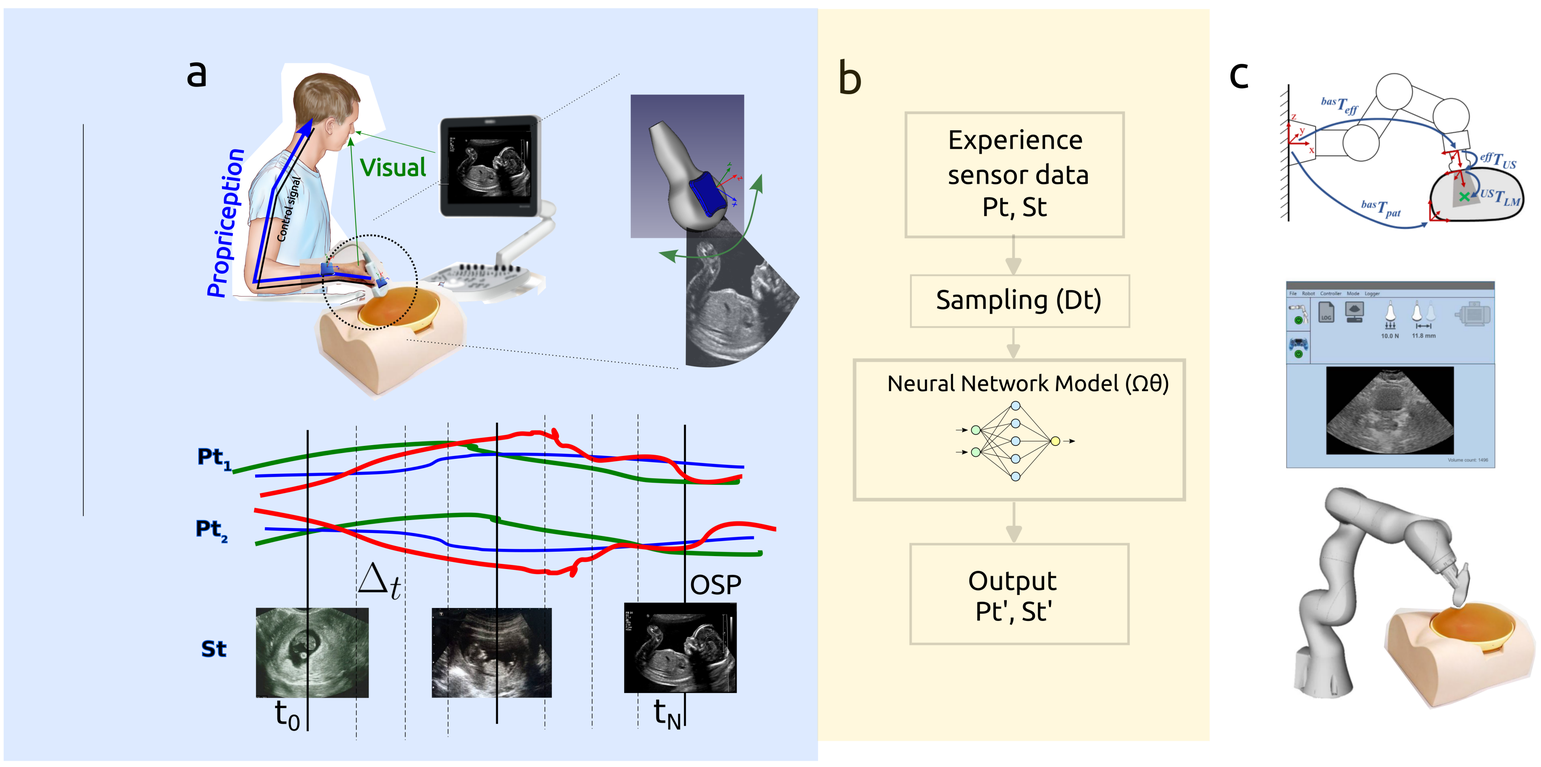
1. INTRODUCTION

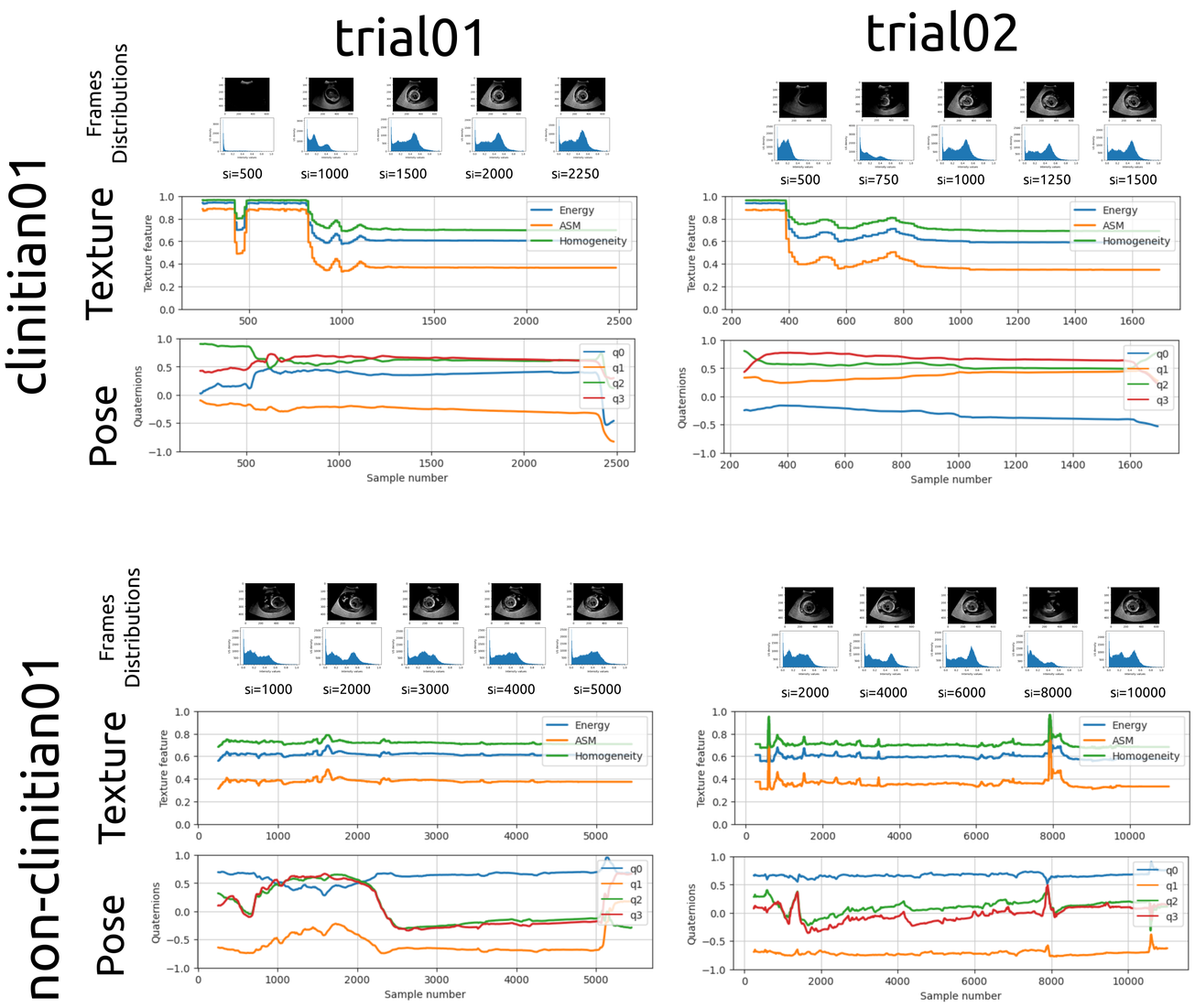
Ultrasound (US) imaging is a popular imaging modality because of its affordability, non-ionising imaging, and real-time capabilities [1]-[3]. Recently, the field of ultrasound-guidance procedures has been advanced with the development of robotic ultrasound systems that range from tele-operated, semi-autonomous and fully autonomous [1-3]. However, there are still scientific and technical challenges in robotic ultrasound-guidance procedures: (a) traditional imaging is user-dependent, skill-dependant and device-dependent [4], (b) traditional hardware for human motion tracking is usually expensive or cumbersome [5], and (c) frameworks are designed for specific types of sensors, clinical US devices, robots and operating systems [6]. Learning ultrasound skills from sonographers that look for the optimal scanning plane (OSP) is still an open challenge in robotic ultrasound-guidance procedures [1]. It is hypothesised that robotic ultrasound-guided procedures would require to be simple, less expensive and less cumbersome for skill transfer learning.

2. SIMPLE FRAMEWORK FOR SKILL TRANSFER LEARNING



3. EXPERIMENTS: DESIGN & RESULTS

We conducted a pilot experiment with two participants (one non-clinical and one clinical with 10 years of experience in echocardiography). Figure shows the time series from one experienced clinician and one non-clinician while looking for an optimal scanning plane of the four-chamber view.



4. CONCLUSIONS & FUTURE WORK

* We have presented a simple framework of skill transfer learning for robotic ultrasound-guidance procedures.
* We presented sensor fusion methods and sampling rate techniques for optimal scanning plane of the four-chamber view from two participants.
* We showed that experienced clinician showed an smother and quicker procedure compare to a lengthy and non-constant movement of non-clinician.
* For future work, we pointed out the need of pruned and quantised neural network models for real-time applications in robotic ultrasound-guidance procedure.

5. REFERENCES

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