A Survey of Medical Image Registration

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August 2, 2018

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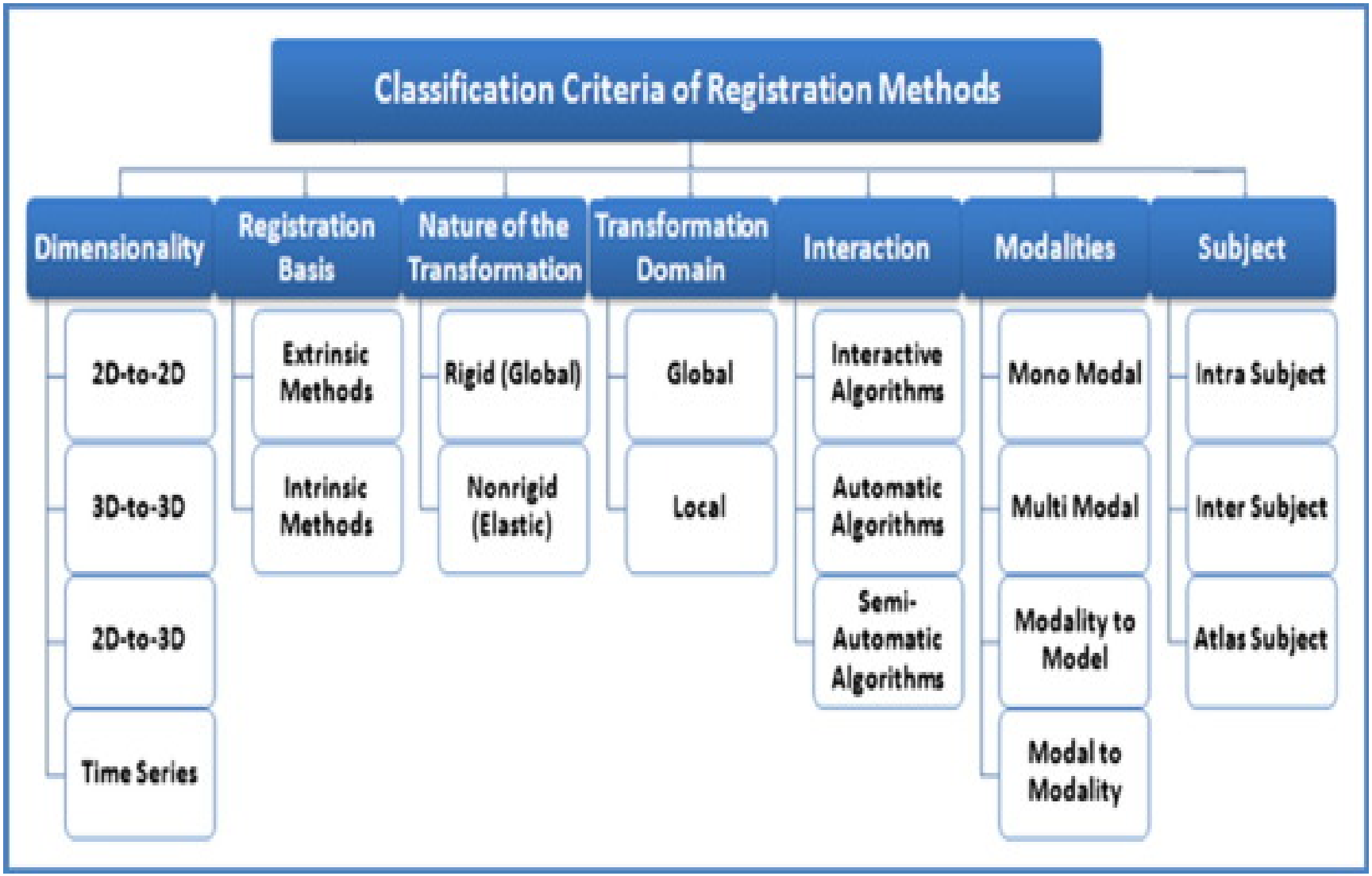
Introduction

- The process of overlaying two or more images of the same scene with respect to a particular reference image.
- Images may be taken at various circumstances (time-points) and various perspectives (Viewpoints) .

Classification



Nature of Registration

- **Rigid** : Described using a single constant matrix (a) equation: $y_i = a_{ij}x_j$ where x and y are the old and new coordinate vectors.
- **Non - Rigid** : Curved transformations cannot be represented using constant matrices .

Domain of Registration

- **Global** : Transformation is applied to entire image .
- **Local** : Subsections of the image have their own transformations defined .

Recent Trends

- Shift from Extrinsic to Intrinsic Registration.
- No need to segment objects which are to be aligned.
- Consider the entire image as input.
- Several datasets with expert landmark annotations have become available.
- Few datasets have been setup for evaluation of registration methods.
- Annotated datasets are provided by DIRLAB, POPI, EMPIRE10, LONI, ADNI.
- EMPIRE10 was launched as evaluation challenge in conjunction with MICCAI 2010.

Challenges

- Non-linear registration methods have not reached the status of inclusion in commercial software for lack of genericity and robustness.
- Global rigid registration is currently the most frequently used registration in clinical approach.
- Level of accuracy needed for clinical purpose is not known.
- EMPIRE10 challenge is employed for registration evaluation.
- Many mono-modal registration problems have been solved.

Conclusion

- There is a shift from extrinsic to intrinsic registration.
- Shift from surface based registration to intensity based registration.
- Emerging need of public database.
- It has proven difficult to devise registration methods that are robust against the many variations encountered in clinical practice.e.g scanner type, scanning protocol, patient -characteristics.
- Most mono-modality registration problems have been solved.

References

The End