HW5 STAT5376

Dynamic programming with SRSF

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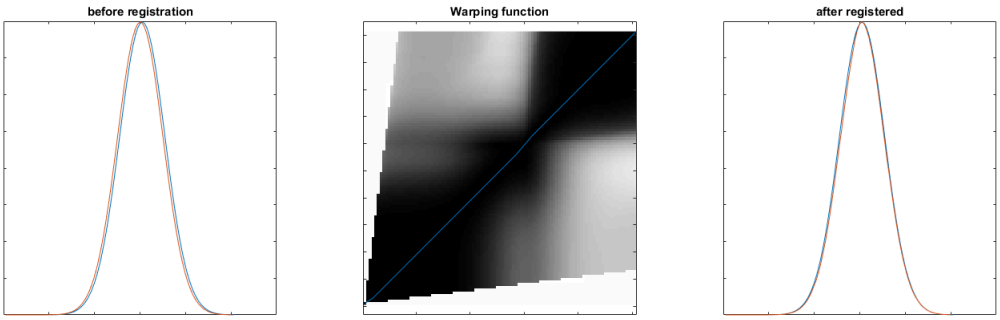
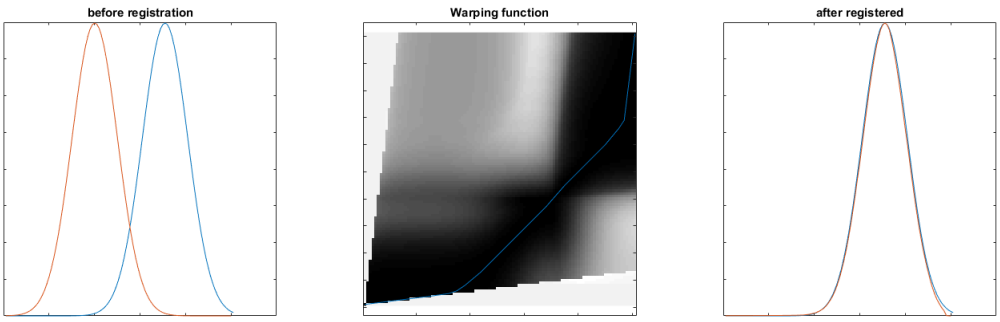
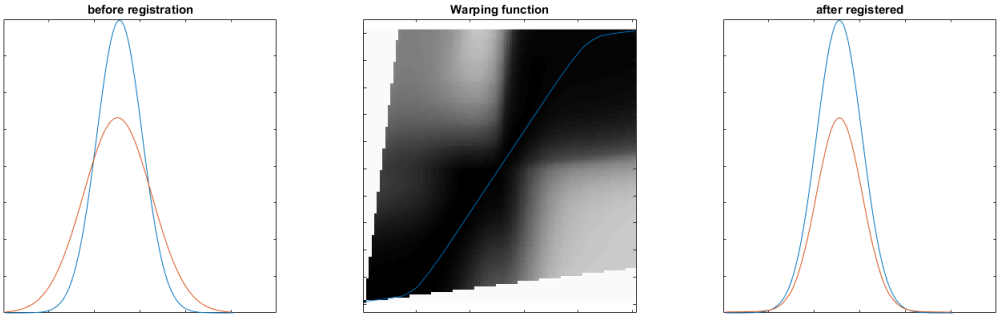
PART I: Smooth function registration
To demonstrate the dynamic programming with SRSF, I simulated several pairs of functions and try to register them.
1.First to register two identical function.



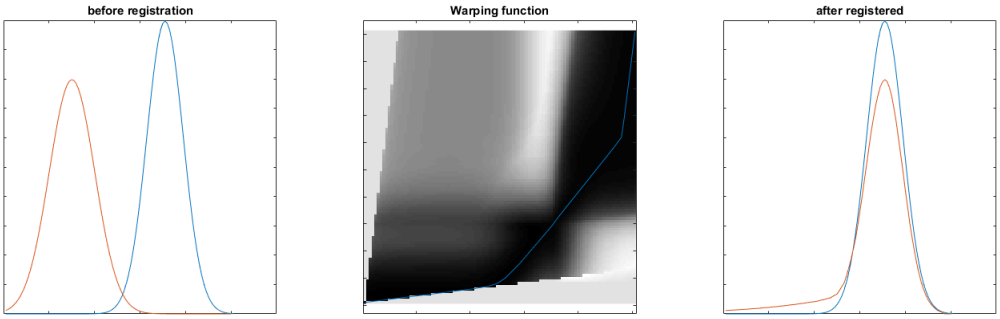
da=0
dp=0
2.Register 2 functions with different locations but exact same shapes



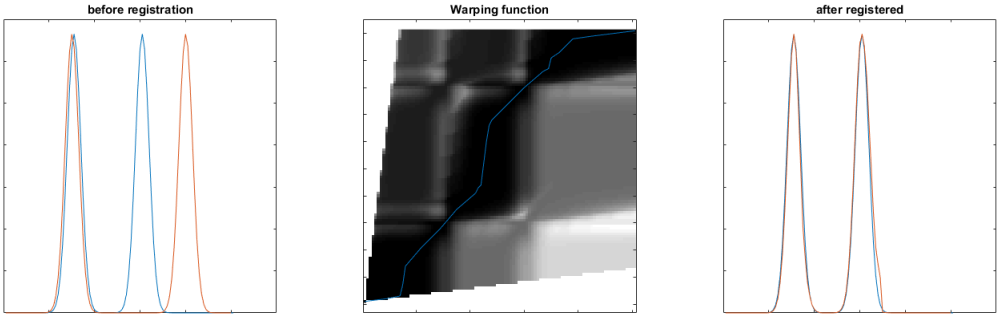
da=0.0466
dp=0.8591
3.Functions with different variation but same location.



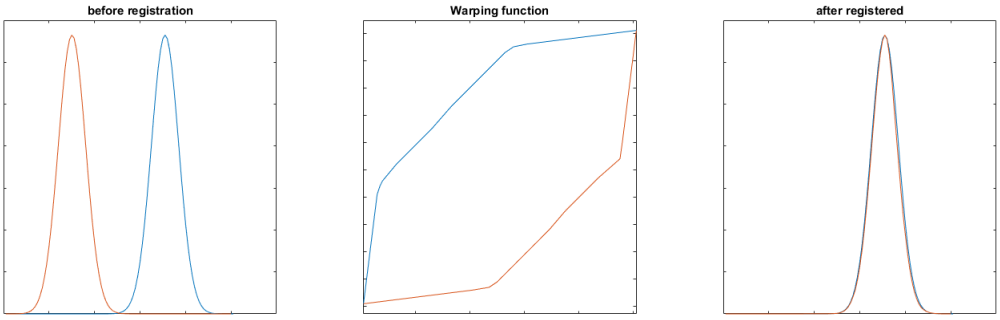
da=0.2688
dp=1.2325
4.Functions with different center and different variations.



da=0.3638
dp=1.0277
5.Let's try warp bi-peak function.

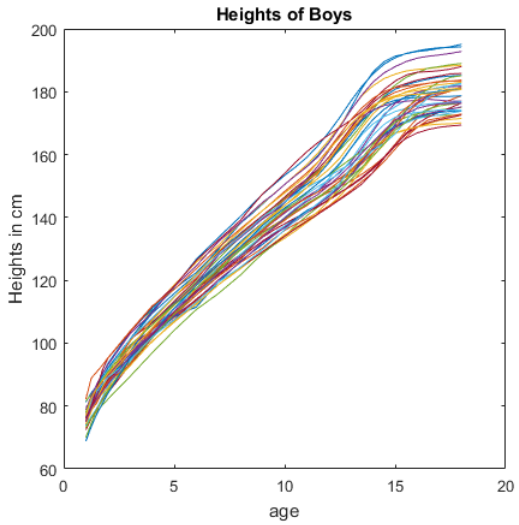


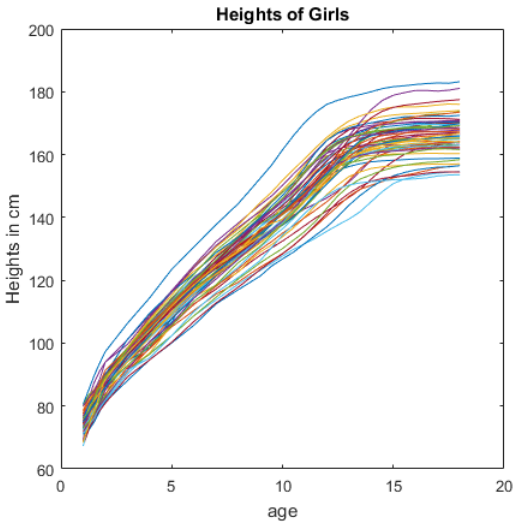
da=0.0014
dp=0.3911
6.If warp g to f, can we observe inverted warping function?



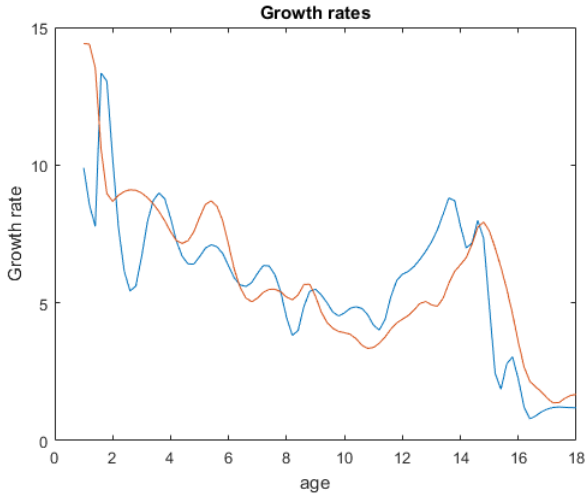
Above all, the algorithm searches 43 points as neighbors with 43 different slopes. It calculate fast and works well under most situations.Indeed, if we change the order of 2 functions to be warped, the warping function is inverse to each other.
However, I do observed some distortion when I tried to register a curve with larger magnitude to another curve with lower magnitude. The magnitude is well reserved which is an improvement comparing to L2-norm registration.

PART II: smooth and register growth data.
Data from R package fda as in following figure:

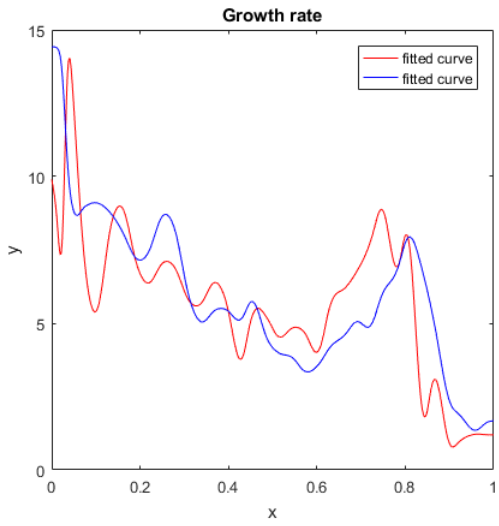


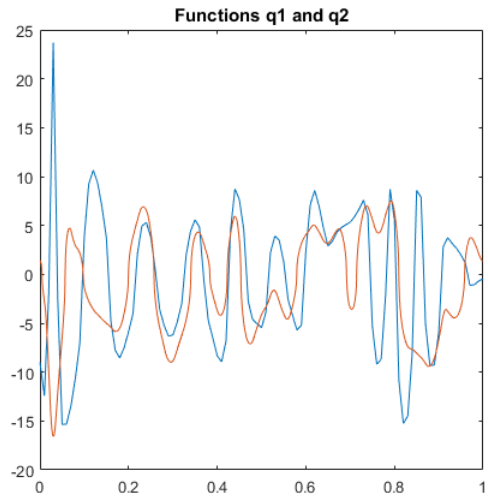


Because we are interested in the growth rates instead of absolute heights, so I first smooth the data and get a growth rate function of 2 random curves.

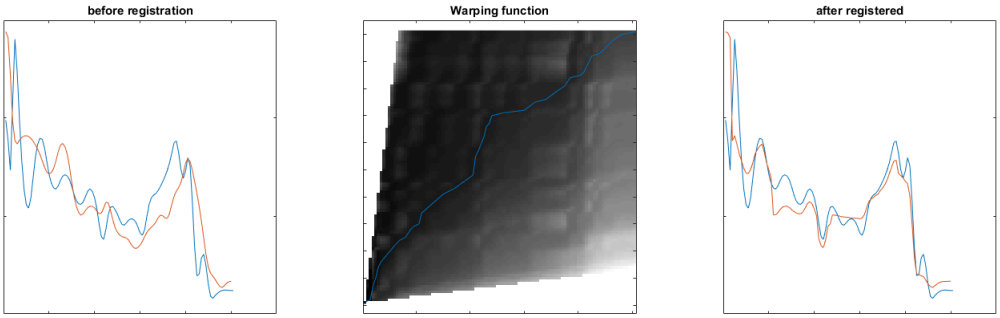


Next, I smoothed the growth rates curve and converted them to SRSF functions q1 and q2 which are ready for registration.

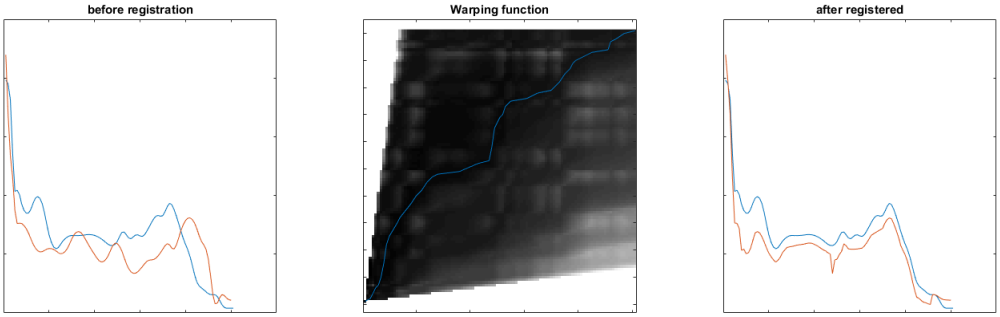




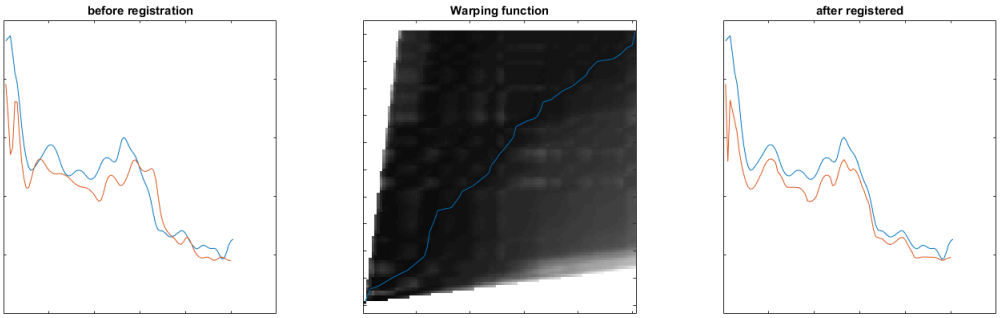
Now I applied dynamic programming with SRSF representations



Try another pair of boys



Try another pair of girls



Above all, the algorithm seem to work well for growth data.
All code please see https://github.com/rikku1983/STAT5376

Thanks!