PROCEEDINGS of ISMA 2019
International Symposium on Music Acoustics

13 - 17 September 2019 in Detmold, Germany

Relation between subjective evaluation for proficiency, expression or technique and acoustic feature on violin performance

Madoka OKEMOTO[1]; Masanobu MIURA[2]

(1) Graduate School of Engineering, Hachinohe Institute of Technology, Japan, unkomgn@gmail.com
(2) Faculty of Music, Kunitachi College of Music, Japan, miura.masanobu@kunitachi.ac.jp

Abstract

Studies of proficiency estimation for musical performances have been intensively conducted in the field of performance science. In most of the studies, feature parameters are calculated from each sound of performances to estimate performance proficiency. However, most cases in the studies estimated only proficiency score, did not estimated expression or technique scores, although they are thought as important for the proficiency estimation. Therefore, this report tries to clarify a relation of subjective evaluation concerning proficiency, expression or technique to acoustic features on violin performances. Moreover, most important parameter on the three scores are discussed. Firstly, five professional violin players gave scores for proficiency, expression and technique to 100 performances for the simple major scale starting from 261Hz or C3 with vibrato. Then, a set of 106 parameters are calculated from the 100 performances. By using the parameters, scores for proficiency, expression and technique are estimated using the liner regression with relative weights for each parameter, so that we confirm the most effective parameters on the estimation. As the results, most important parameters on each score are: the FM vibrato parameter on proficiency, the strength on attack for each note on expression, and the smoothness on consecutive two notes on technique. At the conference, the authors will explain the results in detail on their presentation.

Keywords: Sound, Music, Performance, Violin, Acoustic parameter

1 INTRODUCTION

Estimating the proficiency of musical performances is difficult for novice musicians but desired for their self-learning. Tuns, computational estimation of performance proficiency has been studied [1,2]. A previous study by the authors examined proficiency estimation by using acoustic parameters that include tone duration, tone pitch, AM vibrato, FM vibrato, and so forth. Estimation accuracy of the study was .78 in terms of correlation coefficient between rated and estimated scores. However, that study focused on only proficiency score and did not focused on expression or technique score, even though they are important for proficiency score. Moreover, previous studies did not examine the relation between the parameters and the scores of proficiency, expression and technique for violin performances.

2 AIMS

This study estimates scores of proficiency, expression and technique with the liner regression using 106 parameters proposed by a previous study, and confirms relations between effective parameters and scores of proficiency, expression and technique for violin performances.

3 RELATIONS BETWEEN PARAMETERS AND SCORES

3.1 Method

Firstly, scores of proficiency, expression and technique are estimated by the liner regression using 106 parameters [2]. Second, the relative weights of the liner regression are calculated to confirm the effectiveness to the scores of proficiency, expression and technique for violin performances. In addition, the algorithm M5[3] is

[1] unkomgn@gmail.com
[2] miura.masanobu@kunitachi.ac.jp.

employed to conduct the liner regression in this report.

3.2 Violin performance

Employed sheet music is a “C-major scale with A4 = 440Hz master tuning with vibrato”. Figure 1 shows the sheet music of the musical task. Numbers in Figure 1 are fingering number. Audio of 100 performances (10 persons * 10 trials) are recorded, on which the ten persons are amateur players.

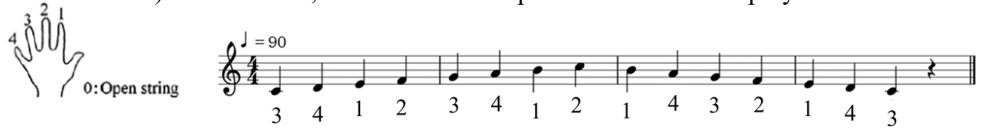

Figure 1. Sheet music

3.3 Scores of proficiency, expression and technique

The scores of proficiency, expression and technique are given by 5 evaluators. The 5 evaluators were graduated from musical university, and are currently players or instructors of the violin as their main work. The recorded audio of the 100 performances were presented in a random order for every task. The experts were asked to evaluate them based on 10 steps from 1 to 10 with the best performance being a 10 about proficiency, expression or technique.

3.4 Parameters

Table 1 shows parameter set. Used parameters by a previous study[2] are combination with acoustics and statistics parameters (the total amount 106 parameters). The acoustic parameters are calculated by each tone in the sheet music, and the statistic parameters are calculated by that calculated the acoustic parameters are calculated to all 11 tones in the sheet music. The acoustic parameters are tone pitch, AM vibrato, FM vibrato, and so forth. The number of the acoustic parameters are 21. The statistic parameters are the average (Ave), the standard deviation (P_0) and 4 parameters (P_0 ~P_4). The 4 statistic parameters (P_0 ~P_4) are parameters relating to tendency curve by 11 tones of the sheet music. The amount of the statistic parameters is 6.

Table 1. Parameter set

	Ave	P_0	P_1	P_2	P_3	P_4
Onset	●	●	●	●	●	●
Duration	●	●	●	●	●	●
St	●	●	●	●	●	●
Tempo	●	●	●	●	●	●
P2P	●	●	●	●	●	●
Diff_peak	●	●	●	●	●	●
Diff_bottom	●	●	●	●	●	●
Relative_SC	●	●	●	●	●	●
Sigma_flux	●	●	●	●	●	●
F0gap	●	●	●	●	●	●
F0gap_slope				●		
F0gap_tgap				●		
Fm_slope	●	●	●	●	●	●
Fm_times	●	●	●	●	●	●
Fm_wid	●	●	●	●	●	●
Am_slope	●	●	●	●	●	●
Am_times	●	●	●	●	●	●
Am_wid	●	●	●	●	●	●

3.5 Results

Results of the calculated relative weights on the liner regression can be confirmed of most closely related parameter at each score (proficiency, expression and technique). From the obtained results, it is clarified that the proficiency score is most closely related to range of tendency curve of FM vibrato parameters. The expression score is closely related to difference in tendency curve between adjacent tones of velocity. The technique score is

most closely related to average of the difference in amplitude of the two peaks of two tones. Moreover, estimation accuracy of proficiency is .67, expression is .70, and technique is .68, in terms of correlation coefficient.

3.6 Discussion

Estimation accuracy of proficiency, expression or technique are almost same level (.67, .68 or 0.70). However, the highest ten parameters in terms of relative weights on proficiency, expression or technique are not consistent. Figure 2 shows the ten highest parameters with relative weights for proficiency, expression and technique scores. The vertical axis shows relative weights of each score, and the horizontal axis shows the parameter in the order of rank of relative weights. As can be seen in figure 2, the magnitude of relative weights on the technique score are comparatively high, whereas those on proficiency are low, and those on expression are lowest among the three scores. It implies that evaluation for expression does not depend mainly on several parameters whereas the evaluation for technique depends mainly on specific set of parameters. Therefore, it may suggest the difference of complexity of the evaluations on expression and technique aspects.

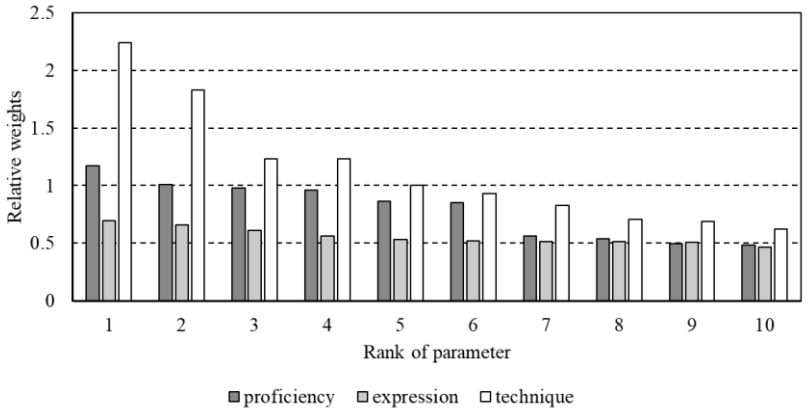

Figure 2. Relative weights on the parameters

4 CONCLUSIONS

Most important parameters on each score are: FM vibrato parameter on proficiency, strength on attack for each note on expression, and smoothness on smooth of two notes on technique. The difference of relative weights on the parameters on the linear regression to estimate the evaluation scores is shown. It may represent the difference of complexity of the evaluations on expression and technique aspects.

REFERENCES

[1] A. Nonogaki, S. Shimazu, N. Emura, M. Miura,S. Akinaga and M. Yanagida, "Use of spline curve to evaluate performance prociency of a Czerny pianopiece", Proceedings of International Symposium on Performance Science, pp.68-74 (2011).

[2] M. Okemoto, M. Miura, "A Proficiency estimation system for violin performance", 15th International Conference on Music Perception and Cognition: Abstract book, p.501 (2018).

[3] H. Akaike, "A new look at the statistical model identification.", Selected Papers of Hirotugu Akaike. Springer, pp.215-222 (1974).