The Go Rating System of Igor Goliney

Franco Pratesi

Usually the playing strength of a Go player is determined by his.rank or his rating or both of them. Ranks correspond to rather coarse sections, whereas ratings allow for finer measurements. If a suitable rating scale is available, it will then be possible to establish accurate ranks for selected intervals of it.

In principle, the best possible kind of rating uses a ratio scale, as the Kelvin scale is for temperature. At least two such scales have been suggested for Go (*BGJ 124*, 2001, pp. 42-43), but major basic problems remain for their application. Before a satisfactory ratio scale is applied to Go players, it may be reasonable to search for partial solutions.

The system discussed here is a recent one and is shortly described, together with its results, at: holigor.fcpages.com/baduk.htm.

It does not deal with the whole range of playing strength; in particular, weak players are not considered at all, even if there is no theoretical lower limit of strength to be observed.

The author of this rating system is Dr. Igor Goliney. He was born in 1960 in Ukraine and graduated there at Kiev State University; in 1989 obtaining his Ph.D. as a theoretical physicist. After working in the Kiev Institute for Nuclear research, he is now active at the National University of Singapore.

Igor Goliney has been kind enough to discuss with me several points of his system and even to perform a few tests, inserting in his system simulated games against players at the theoretical limits of strengths, such as a perfect winner and a perfect loser. Among the following paragraphs, a few are extracted or verbatim copied from his pages, others derive from our private correspondence, including the results of the simulation mentioned.

One of the starting points for this original system has been the need for a more reliable comparison of the relative strength of Go champions. Everybody knows, for instance, that the number of Japanese professional players in the 9th rank has greatly increased in recent times – even if they belong to the same and highest rank, they certainly do not have

exactly the same strength. A connected question is how to compare the strongest professionals of different countries, in the absence of a significant number of international competitions.

Another starting point has been Goliney's mathematical knowledge, indicating that the usual way for finding exploitable physical laws consists in the minimisation of suitable functions or functionals.

With respect to the various ranking systems proposed, Igor Goliney approaches a connected but different problem: how to rate the strongest players in a completely objective way, simply on the basis of the games that they are playing among each other, without assuming for any player a preliminary value of strength, to be adjusted later on.

The rating table of this system is built by the minimization of the function,

$$F = \Sigma\ a_k\ (x_i - x_j - r_k)^2$$

where
x_i and x_j are unknown ratings of the players.
r_k is the result of the match, 1 or -1 depending on the win or loss of the first player.
a_k is a coefficient that describes the importance of the match; for the moment, the only contribution comes from aging of the results, which consists in the decrease of the coefficients a_k in the function and is performed on the tournament basis.
The formula is $a_k = 1 - \exp(-y)$
where y is the number of years from the tournament.

Summation is performed over all games in the database, which includes all results found at: www.kyoto.zaq.ne.jp/momoyama/news/news.html.

These are international tournaments and the major domestic tournaments in Japan, Korea and China.

Handicap games are not present in the database, and the presence of various conventional values for komi is not taken into account; at the moment, it is only a matter of win or loss. It is useful that the strength of the players selected is not too different – otherwise, the evaluation function itself would be bad, punishing the stronger player.

Moreover, for providing a 'correct' order for weaker players, it would be necessary to have games among everybody, whereas weaker

players seldom find an opportunity to play with the champions. The actual situation is thus such that only the strongest players can be ordered in a reliable way with this system.

After minimization, the least rating is found and the whole set is shifted to make it zero; thus all ratings are made positive, and then are multiplied by 1000 before the final presentation.

To avoid unreliable situations, a devaluation of the rating of players with few games is implemented. This has a damping effect on fluctuations of their ratings up to approximately 20 games. Then, in the region 20-40 games, fluctuations are yet big enough, but the damping does not work anymore. For a larger number of games the statistics takes over and the rating becomes more firmly established.

The situation as of beginning August 2003 (when the database used as source has been interrupted, planning only to continue when the Japanese masters again achieve world leadership) is shown in the Table (overleaf) for the first 60 entries.

The order of strength established by Goliney's system is rather different from any ordering expected for the best players. Goliney's rating system indeed makes the emphasis on the level of player's opponents – this factor is almost as important as the ratio of wins and losses.

We usually feel a notable respect for the strongest players, who have established their value in the course of years. Often, however, a player becomes universally known, and at the same time approaches the descending part of his playing career.

On the contrary, this system tends to overestimate young players with few games but high percentage of wins. The system is thus useful to indicate future champions, young players – in several cases yet unknown among Go fans – who win a few games against the champions. It thus occurred that the high strength of players as Cho U, Song T'aekon, Yamashita Keigo, and Takao Shinji were clearly indicated by the system, before their following greatest successes.

A possible use of these ratings for correctly determining players' ranks is not immediate. However, if we select a kind of Elo ranks with 75% winning probability for distinguishing rank partitions, this would correspond to a 721-point difference; that is, about the distance between Yi Ch'ang-ho and Rin Kaiho.

No	Player	rating	M-W:L	No	Player	rating	M-W:L
1.	Yi Ch'ang-ho	4220.01	238:177-61	31.	O Meien	3741.04	172:99-73
2.	Yi Se-tol	4105.46	211:144-67	32.	Ding Wei	3728.57	88:50-38
3.	Kong Jie	4076.01	113:78-35	33.	Kobayashi Koichi	3714.1	150:80-70
4.	Wang Lei	4055.25	98:66-32	34.	Rui Naiwei	3699.28	124:81-43
5.	Cho Hun-hyeon	4013.84	231:152-79	35.	Ch'oe Myeong-hun	3683.23	90:46-44
6.	Gu Li	4001.18	105:73-32	36.	O Rissei	3673.51	187:99-88
7.	Song T'ae-kon	3998.29	66:45-21	37.	Shao Weigang	3664.31	93:48-45
8.	Kim Chu-ho	3992.11	33:22-11	38.	Ma Xiaochun	3660.17	101:51-50
9.	Yamashita Keigo	3961.55	155:107-48	39.	Ch'oe Ch'eol-han	3650.62	63:33-30
10.	Yu Ch'ang-hyeok	3957.99	206:132-74	40.	Kato Masao	3639.83	136:77-59
11.	Cho U	3950.75	143:95-48	41.	Yun Seong-hyeon	3627.16	46:18-28
12.	Mok Chin-seok	3945.23	137:88-49	42.	Peng Quan	3626.83	73:41-32
13.	Yu Bin	3923.51	120:72-48	43.	Yi Sang-hun	3606.44	44:24-20
14.	Yoda Norimoto	3923.08	128:81-47	44.	Kim Myeong-wan	3601.78	32:19-13
15.	Liu Xing	3908.98	55:35-20	45.	Yuki Satoshi	3596.67	77:44-33
16.	Takao Shinji	3906.64	83:54-29	46.	Paek Tae-hyeon	3590.19	42:21-21
17.	Chang Hao	3902.97	166:98-68	47.	An Tal-hun	3583.14	41:20-21
18.	Cho Han-seung	3896.92	107:61-46	48.	Dong Yan	3583.06	69:37-32
19.	Kobayashi Satoru	3890.07	67:41-26	49.	Liu Jing	3582.17	73:36-37
20.	Zhou Heyang	3874.94	125:82-43	50.	Kiyonari Tetsuya	3581.98	25:13-12
21.	Pak Yeong-hun	3842.8	99:60-39	51.	Rin Kaiho	3579.82	117:61-56
22.	Hu Yaoyu	3836.67	89:52-37	52.	Nie Weiping	3579.66	62:31-31
23.	Xie He	3836.39	63:39-24	53.	Pak Pyeong-kyu	3577.39	25:13-12
24.	An Cho-yeong	3825.23	75:38-37	54.	Huang Yizhong	3571.58	83:44-39
25.	Mimura Tomoyasu	3825.2	50:31-19	55.	Komatsu Hideki	3564.75	36:18-18
26.	Cho Chikun	3812.56	214:130-84	56.	Luo Xihe	3564.7	99:51-48
27.	Akiyama Jiro	3810.49	53:32-21	57.	Yun Hyeon-seok	3547.82	42:18-24
28.	Hane Naoki	3795.66	162:97-65	58.	Kim Shujun	3546.44	41:25-16
29.	Yamashiro Hiroshi	3785.42	41:25-16	59.	Wang Yuhui	3533.28	55:24-31
30.	Wang Xi	3780.25	45:28-17	60.	Yun Chun-sang	3521.5	21:11-10

There are further aspects that we would like to have available, however, and in particular how to rate all the players, possibly including such 'theoretical' players as the perfect winner and loser – namely players who always win or lose against anybody else. This system was not built with this purpose, but its response may be checked with input data from simulated games with such nominal players.

After introducing both a perfect loser and a perfect winner in the existing set of players, the rating difference between perfect winner and loser converges to 1000 points, if the number of games between them is larger than the number of any other games in the database. However, the convergence is slow, as the square root of the game number.

If the number of games between the perfect players is not large enough, two pools are formed. With respect to the average player, the perfect loser is 1000 points below in the database (because of constant losses), whereas the perfect winner is 1000 points above. The difference between the perfect players themselves is about 2000 points.

If instead we try and extend the system to include all existing Go players, in actual conditions, the range of all the ratings from a beginner to the strongest player can only be roughly estimated to correspond to about 50,000. The reason of the increasing interval has to be searched in the missing games between players of greatly different strength – these games are not present in the database used, but even in actual practice are far from frequent.

In conclusion, Goliney's system appears to be a valid tool, which fulfils its proposed goal of ordering the playing strength of the strongest active players. Clearly, the system is based on a mathematical treatment of existing data that cannot be adjusted to favour one or another player. It thus provides a completely impartial way to order the strongest players of the world, independent of their career, age, or country.

At the same time, our search for a ratio scale, suitable for correctly representing the strength of all Go players, down to the weakest ones, must go on.