The Right Arm Bias in ITF Taekwon-Do Patterns Chon-Ji to Juche

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Abstract

When performing patterns in ITF Taekwon-Do, one of the factors mentioned in the condensed Encyclopedia is that there should be an equal number of techniques to both sides of the body. Here we analyze hand techniques in Chon-Ji through Juche to establish whether or not there is a bias towards either side. This is done by attaching metadata, in the form of tags, to each pattern movement. These tags are generated from the Encyclopedia's description of the movements, and supplemented by keywords that were identified by carefully examining each pattern. We then apply concepts from set theory to retrieve the information we are interested in, and find that there are seven more techniques on the right side than on the left.

1. Introduction

A *pattern* in International Taekwon-Do Federation (ITF) is defined as a choreographed sequence of fundamental movements. These *fundamental movements* are basic elements which represent an attack or defense against a specific target area, or a predetermined action of an attacker.

Combined in a pattern, it allows the student to systematically deal with one or several imaginary opponents using every available attacking and blocking tool from different directions. In addition, the techniques should also be evenly distributed between the left and the right side[1].

It has, however, recently been observed that there is a bias towards the right leg. The study by Gibbs[3] show that there is a total of 152 kicks in patterns Chon-Ji to Tong-Il. 85 kicks are with the right leg, and 67 kicks are with the left leg. This means that 56 % of the kicks are with the right leg, and 44 % are with the left leg.

The work by Gibbs focused on kicks in all patterns, whereas this article examines patterns Chon-Ji to Juche. Looking at kicks in these patterns using Gibbs' paper, we find that there are 72 kicks in total. 42 kicks are with the right leg, and 30 kicks are with the left leg. Roughly 58 % of the kicks are with the right leg, and about 42 % with the left. Thus, the right leg bias still holds.

In this article we analyze hand techniques in patterns Chon-Ji to Juche using tags, and then report our findings of a right arm bias.

1.1. Tags

In a hierarchical and exclusive classification system, each object belongs to one unambiguous category, which in turn belongs within another more general category.

Take the hierarchy of folders in a computer file system, for example. How we choose to organize the folders reflects a decision concerning the relative importance of each characteristic[4].

Folder names are in themselves informative, in that, like tags, they describe the information held within them[8]. Furthermore, the way folder names relate to each other shows a structural relationship between directories[9].

Tags, on the other hand, are non-hierarchical descriptive terms, keywords or labels that is attached to an object for later retrieval [4][7][10].

They are *non-hierarchical* and *inclusive*, which is to say that an object can be associated with a great variety of tags simultaneously[4]. The *descriptive terms*, *keywords* or *labels* are metadata connected to a given object that describes a concept or type of information[5].

1.2. Tagging

Tagging is the act of organizing a collection of objects into related groups[10].

1.3. Set Theory

A *set* is a collection of distinct objects. It is "a plurality thought of as a unit"[6]. *Set theory*, then, is the branch of mathematics that studies sets.

An object which has been tagged contains a collection, or a set, of tags. Each tag is an element of the set. The order of elements within the set is irrelevant, but each element can only occur once.

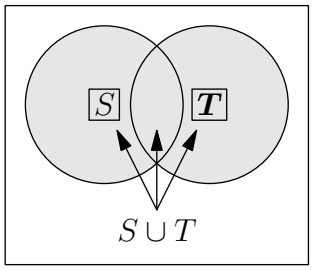
For example, $\{1, 5, 8\}$ is a set with three elements: 1, 5 and 8. $\{5, 8, 1\}$ is the same set, since the order of the elements doesn't matter. $\{1, 1, 1\}$, however, is not a valid set because the element 1 occurs repeatedly. Elements in a set can contain strings as well, so $\{blocks, punches, strikes, thrusts\}$ is also a valid set.

We usually denote a set by a capital letter for reference purposes. For instance, $S = \{1, 5, 8\}$.

$a \in S$ denotes that the object a is a member of the set S. If a is not a member of S, we write $a \notin S$.

The *union* of two sets S and T is the set

$$S \cup T = \{x : x \in S \text{ or } x \in T\}$$

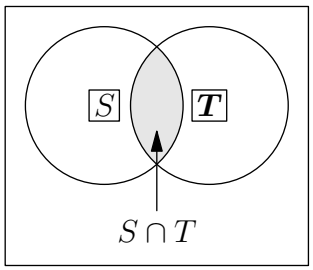


This consists of those objects which lie in the set S or in the set T, or in both. So,

$$\{1, 2, 3\} \cup \{3, 4, 5\} = \{1, 2, 3, 4, 5\}$$

The *intersection* of two sets S and T is the set

$$S \cap T = \{x : x \in S \text{ and } x \in T\}$$

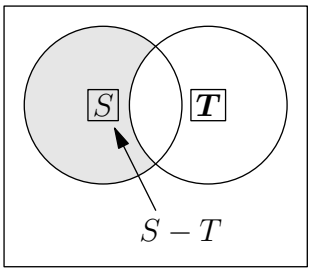


This consists of those objects which lie in both the set S and the set B. So,

$$\{1, 2, 3\} \cap \{2, 3, 4\} = \{2, 3\}$$

The *complement* of a set T relative to a set S is the set

$$S - T = \{x : x \in S \text{ and } x \notin T\}$$

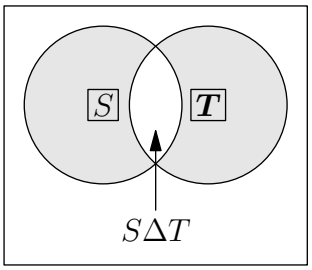


This consists of those objects which lie in the set S but not in the set T. So,

$$\{1, 2, 3\} - \{2, 3, 4\} = \{1\}$$

The *symmetric difference* of the sets S and T is the set

$$S\Delta T = \{x : (x \in S \text{ and } x \notin T) \text{ or } (x \in T \text{ and } x \notin S)\}$$



This consists of those objects which lie either in one of the sets, but not in both. So,

$$\{1, 2, 3\}\Delta\{2, 3, 4\} = \{1, 4\}$$

2. Method

In this section we describe where the data originates. Next we elaborate on the approach taken to register and investigate the dataset. Finally, we look at how each movement has been classified with emphasis on special cases.

2.1. The Data

Our data comes from two different sources. The terminology associated with pattern movements is from Taekwon-Do ITF Sonkal Praha[1], and the English description of each movement is from the condensed encyclopedia[2].

The dataset is organized by pattern names. It contains a list of all techniques in patterns Chon-Ji to Juche. For each movement, the following data has been registered:

1. Movement number
2. English description
3. Terminology
4. Tags

2.2. Approach

The movement number, together with the English description of each movement, was registered manually from the condensed encyclopedia. After reviewing and making minor corrections to the terminology, it too was added to the dataset.

Suitable tags were then attached to every movement by first extracting keywords from their English description, and then adding more detailed tags while performing the pattern.

We then defined the data models with DataMapper, an Object Relational Mapper[2] (ORM) written in the Ruby programming language. The models are Ruby classes with properties and associations. Properties define field names and data types in the database, whereas the associations define the relationships and cardinality between the models.

Next we created a Ruby script that reads the dataset and automatically populates the database. It sets up associations between models, and adds the appropriate tags to every movement, as well as associations between movement and pattern.

Tagging movements in such a formalized manner, and registering it in a database, enables us to retrieve the data we are interested in using concepts from set theory.

2.3. Classification

Classification was done by attaching metadata, in the form of tags, to each pattern movement.

The first movement in Chon-Ji, for instance, is to "[m]ove the left foot to B, forming a left walking stance toward B while executing a low block to B with the left forearm[1]." Removing the redundant parts of the description leaves us with:

$$\{left\ walking\ stance,\ low\ block,\ left\ forearm\}$$

Supplementing the above with more detailed tags gives us:

$$\{walking\ stance,\ left\ stance,\ low\ technique,\ left\ technique,\ block,\ forearm,\ outer\ forearm, normal\ motion\}$$

Information about the stance type is presented first, followed by stance side (left, right or none where applicable — for example a sitting stance), technique height (low, middle, high), technique side (left arm or right arm, it can also be both), direction of the technique (when needed), primary technique type (attack, block, kick), technique group (block, punch, strike, thrust), tool group (forearm, knife hand, finger etc.), tool (inner forearm, outer forearm, double finger etc.), and finally motion type (normal motion, slow motion, consecutive motion and so on).

In most cases, applying tags to movements has been straightforward. However, there are movements that need special mention. These movements fall into two categories.

The first category consists of movements where both arms are part of the technique by either forming the technique, or by being two separate techniques in a single movement.

In cases where both arms are used in one technique, the movement has been tagged with $\{left\_technique,\ right\_technique\}$ to reflect that both arms are needed for the technique, or that the movement contains two separate hand techniques.

An example of a movement where both arms are required to form the technique can be found in the 13^{th} movement of Joong-Gun Tul, which is *Gunnun so kyocha joomuk chukyo makgi*.

When it comes to a movement with two separate hand techniques, the 27^{th} movement of Joong-Gun Tul, being *Nachuo so sonbadak noollo makgi*, serves as a good illustration.

The implications of tagging movements with $\{left\_technique,\ right\_technique\}$ are that the total amount of hand techniques on either side are higher than what actually is the case. This flaw does not affect the bias we are investigating, though.

The second category comprises ambiguous movements, and thus contains clarification on why certain tags were added.

[1] `http://sonkal.taekwondo.cz`
[2] `http://www.datamapper.org`

Below is a list of all the special cases from both categories.

- *Do-San Tul*
  - **Movement 13**, *Gunnun so bakat palmok nopunde hechyo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 17**, *Gunnun so bakat palmok nopunde hechyo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
- *Yul-Gok Tul*
  - **Movement 24**, *Gunnun so ap palkup bandae taerigi*, is tagged with {*front_strike*} due to the English description of striking with the right front elbow.
  - **Movement 27**, *Gunnun so ap palkup bandae taerigi*, is tagged with {*front_strike*} due to the English description of striking with the left front elbow.
- *Joong-Gun Tul*
  - **Movement 8**, *Gunnun so wipalkup taerigi*, is tagged {*upper_strike*, *upper_elbow*} since the English description says that the movement is "a right upper elbow strike."
  - **Movement 10**, *Gunnun so wipalkup taerigi*, is tagged {*upper_strike*, *upper_elbow*} since the English description says that the movement is "a left upper elbow strike."
  - **Movement 11**, *Gunnun so sang sewo jirugi*, is tagged as a left and right technique, with {*left_technique*, *right_technique*}. This increases the total number of punches on both sides.
  - **Movement 12**, *Gunnun so sang dwijibo jirugi*, is tagged as a left and right technique, with {*left_technique*, *right_technique*}. This increases the total number of punches on both sides.
  - **Movement 13**, *Gunnun so kyocha joomuk chukyo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 27**, *Nachuo so son-badak noollo makgi*, is tagged as a {*middle_technique*, *low_technique*} because the left hand is in the middle section and the right hand, forming the pressing block, is in the low section of the body. The movement has, additionally, been tagged as a {*right_technique*, *left_technique*} to reflect that two separate blocks are executed.
  - **Movement 29**, *Nachuo so son-badak noollo makgi*, is tagged as a {*middle_technique*, *low_technique*} because the right hand is in the middle section and the left hand, forming the pressing block, is in the low section of the body. The movement has, additionally, been tagged as a {*right_technique*, *left_technique*} to reflect that two separate blocks are executed.
- *Toi-Gae Tul*
  - **Movement 7**, *Gunnun so kyocha joomuk noollo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 8**, *Gunnun so sang sewo jirugi*, is tagged as a left and right technique, with {*left_technique*, *right_technique*}. This increases the total number of punches on both sides.
  - **Movement 20**, *Gunnun so*, has only the stance registered although the English description says to "[e]xtend both hands upward as if to grab the opponent's head."
  - **Movement 29**, *Gunnun so kyocha joomuk noollo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
- *Hwa-Rang Tul*
  - **Movement 24**, *Gunnun so kyocha joomuk noollo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
- *Choong-Moo Tul*

- **Movement 11**, *Gunnun sogi*, has only the stance registered as part of the terminology though the English description says to "[e]xtend both hands upward as if to grab the opponent's head."
- **Movement 27**, *Niunja so kyocha sonkal kaunde momcho makgi*, is tagged as a left and a right technique with $\{left\_technique, right\_technique\}$. This increases the total number of blocks on both sides.

- *Kwang-Gae Tul*
  - **Movement 21**, *Nachuo so sonbadak noollo makgi*, is tagged as a $\{middle\_technique, low\_technique\}$ because the right hand is in the middle section and the left hand, forming the pressing block, is in the low section of the body. The movement has, additionally, been tagged as a $\{right\_technique, left\_technique\}$ to reflect that two separate blocks are executed.
  - **Movement 22**, *Nachuo so sonbadak noollo makgi*, is tagged as a $\{middle\_technique, low\_technique\}$ because the right hand is in the middle section and the left hand, forming the pressing block, is in the low section of the body. The movement has, additionally, been tagged as a $\{right\_technique, left\_technique\}$ to reflect that two separate blocks are executed.
  - **Movement 31**, *Gunnun so sang sewo jirugi*, is tagged as a left and right technique, with $\{left\_technique, right\_technique\}$. This increases the total number of punches on both sides.
  - **Movement 32**, *Gunnun so sang dwijibo jirugi*, is tagged as a left and right technique, with $\{left\_technique, right\_technique\}$. This increases the total number of punches on both sides.
  - **Movement 36**, *Gunnun so sang dwijibo jirugi*, is tagged as a left and right technique, with $\{left\_technique, right\_technique\}$. This increases the total number of punches on both sides.

- *Po-Eun Tul*
  - **Movement 6**, *Annun so ap joomuk noollo makgi*, consists of two blocks. The first is a "pressing block with the left fore fist," and the second one is a "side front block with the right inner forearm." When searching, this movement will only register as one block.
  - **Movement 7**, *Annun so ap joomuk noollo makgi*, consists of two blocks. The first is a "pressing block with the right fore fist," and the second one is a "side front block with the left inner forearm." When searching, this movement will only register as one block.
  - **Movement 8**, *Annun so an palmok kaunde hechyo makgi*, is tagged as a left and a right technique with $\{left\_technique, right\_technique\}$. This increases the total number of blocks on both sides.
  - **Movement 24**, *Annun so ap joomuk noollo makgi*, consists of two blocks. The first is a "pressing block with the right fore fist," and the second one is a "side front block with the left inner forearm." When searching, this movement will only register as one block.
  - **Movement 25**, *Annun so ap joomuk noollo makgi*, consists of two blocks. The first is a "pressing block with the left fore fist," and the second one is a "side front block with the right inner forearm." When searching, this movement will only register as one block.
  - **Movement 26**, *Annun so an palmok kaunde hechyo makgi*, is tagged as a left and a right technique with $\{left\_technique, right\_technique\}$. This increases the total number of blocks on both sides.

  Movements 6, 7, 24 and 25 for pattern Po-Eun also have the following tags attached:

  $\{sitting\_stance, low\_technique, high\_technique, left\_technique, right\_technique, block, pressing\_block, fore\_fist, forearm, inner\_forearm, side\_front\_block, continuous\_motion\}$

- *Ge-Baek Tul*
  - **Movement 1**, *Niunja so kyocha sonkal kaunde momcho makgi*, is tagged as a left and a right technique with $\{left\_technique, right\_technique\}$. This increases the total number of blocks on both sides.

- **Movement 7**, *Gunnun so nopunde doo bandalson makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
- **Movement 20**, *Annun so gutja makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
- **Movement 23**, *Twimyo yopcha jirugi*, the height of the kick is not registered.
- **Movement 24**, *Gunnun so sang sewo jirugi*, is tagged as a left and right technique, with {*left_technique*, *right_technique*}. This increases the total number of punches on both sides.
- **Movement 25**, *Gunnun so nopunde doo bandalson makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
- **Movement 34**, *Gunnun so sang sewo jirugi*, is tagged as a left and right technique, with {*left_technique*, *right_technique*}. This increases the total number of punches on both sides.
- **Movement 36**, *Annun so gutja makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.

- *Eui-Am Tul*
  - **Movement 5**, *Gunnun so kyocha joomuk naeryo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 18**, *Gunnun so kyocha joomuk naeryo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 27**, *Gunnun so sonkal kaunde hechyo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 29**, *Dwitbal so sang sonbadak naeryo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 32**, *Gunnun so sonkal kaunde hechyo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 34**, *Dwitbal so sang sonbadak naeryo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.

- *Choong-Jang Tul*
  - **Movement 18**, *Gunnun so kyocha joomuk noollo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 19**, *Moorup najunde apcha busigi*, is tagged with {*front_snap_kick*, *knee*} because the English description says to perform "a low front snap kick to C with the right knee." This has an effect on the total number of low front snap kicks.
  - **Movement 24**, *Dwitbal so sang sonbadak noollo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 38**, *Gunnun so bandae gutja makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.
  - **Movement 40**, *Gunnun so bandae gutja makgi*, is tagged as a left and a right technique with

{*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.

– **Movement 41**, *Gunnun so sang sonkal soopyong taerigi*, is tagged with {*knife_hand*, *twin_knife_hand*}.

- *Juche Tul*

  – **Movement 1**, *Annun so an palmok narani makgi*, is tagged as left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.

  – **Movement 4**, *Waebal so bakat palmok narani makgi*, is tagged as a left and a right technique with {*left_technique*,: *right_technique*}. This increases the total number of blocks on both sides. The movement also has the tag {*parallel_block*} attached to it.

  – **Movement 13**, *Annun so an palmok narani makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.

  – **Movement 16**, *Waebal so bakat palmok narani makgi*, is tagged as a left and a right technique with {*left_technique*,: *right_technique*}. This increases the total number of blocks on both sides. The movement also has the tag {*parallel_block*} attached to it.

  – **Movement 38**, *Sasun so sang sonbadak chookyo makgi*, is tagged as a left and a right technique with {*left_technique*, *right_technique*}. This increases the total number of blocks on both sides.

3. Results

Our findings show that of 519 techniques, 256 (49 %) are with the left arm and 263 (51 %) with the right arm (Table 1). Looking at the total amount of techniques, only 7 techniques (about 1 %) separates an even distribution to both sides.

3.1. Techniques by Category

In terms of category distribution, there are more blocks on the left side than on the right side. There are, therefore, more attacks on the right side, than on the left side (Figure 1, Table 2).

	Left Arm	Right Arm
Blocks	148	133
Punches	60	71
Strikes	34	38
Thrusts	14	21
Total	**256**	**263**

Table 1: Number of techniques per arm by category.

	Left Arm	Right Arm
Blocks	57.81 %	50.57 %
Punches	23.44 %	27.00 %
Strikes	13.28 %	14.45 %
Thrusts	5.47 %	7.98 %
Total	**100 %**	**100 %**

Table 2: Percent distribution of techniques per arm by category.

3.2. Techniques by Height

Techniques by height follow the same trend when looking at all techniques combined or techniques to either side. Most of the techniques are in the middle section, although there is a greater occurrence of strikes in the high section, and very few attacks in the low section (Figure 2).

3.3. Techniques by Stances

Because most techniques are performed in walking, sitting and L stances, the graphs in this section have been split into two groups. One group shows the majority of

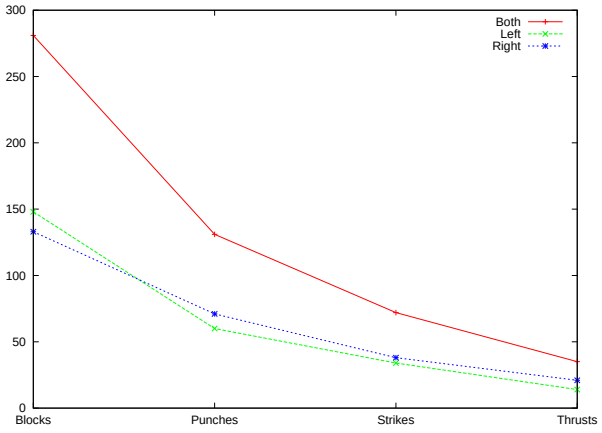


Figure 1: Distribution of techniques by category.

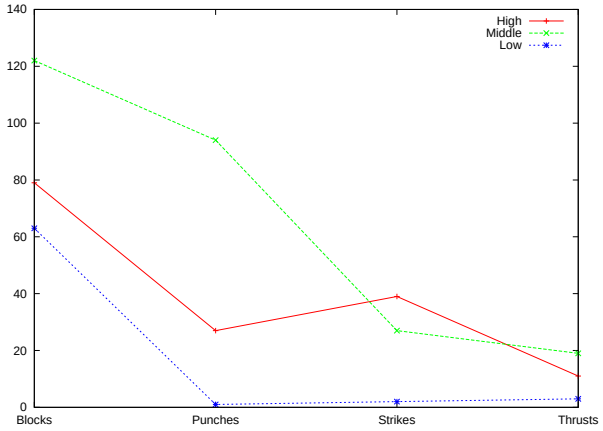


Figure 2: All techniques by height.

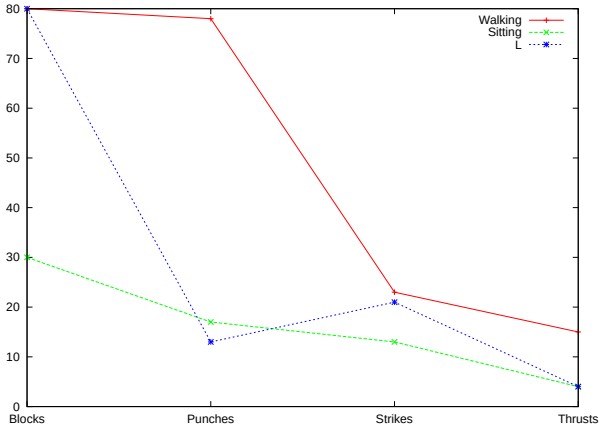


Figure 3: All techniques by walking, sitting and L stances.

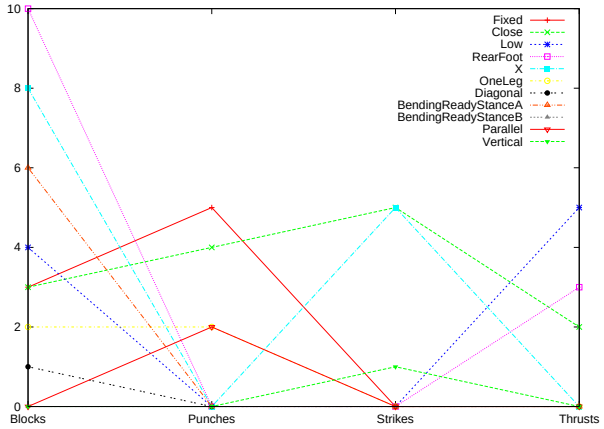


Figure 4: All techniques by stances except walking, sitting and L stances.

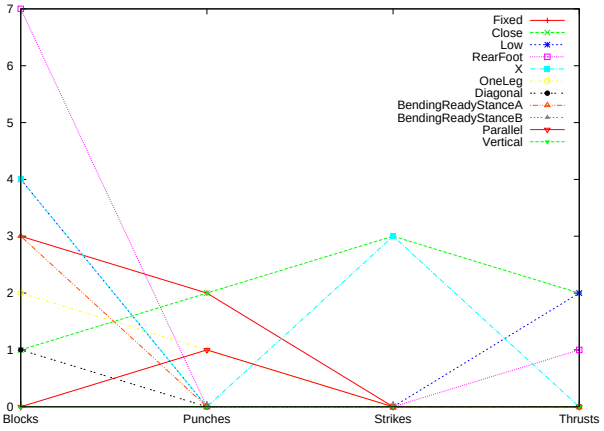


Figure 5: Left techniques by stances except walking, sitting and L stances.

techniques (84 %), while the other visualizes techniques performed in the remaining stances (16 %).

When looking at all techniques by walking stances, sitting stances and L stances (Figure 3), they roughly follow the same pattern on both sides. There are, however, two minor exceptions. Firstly, there are more strikes in L stances compared to walking stances on the left side. Secondly, there are more punches than blocks to the right side.

When we look at all techniques excluding the frequently used walking, sitting and L stances (Figure 4), we find that there is an even distribution of techniques except for the closed stance, the fixed stance and the vertical stance, which have more techniques to the right side (Figure 5) than to the left (Figure 6).

There are some additional stances which needs special mentioning. The closed stance is the only stance

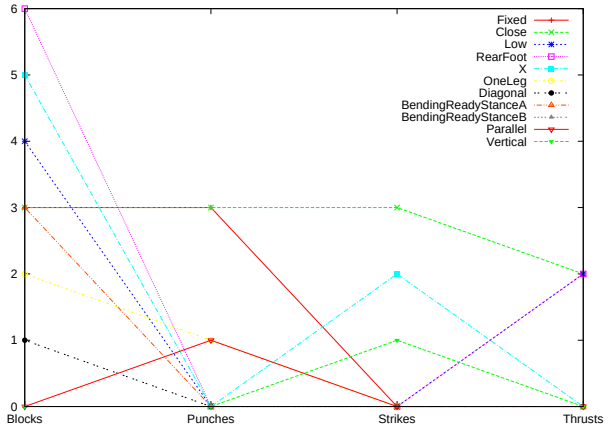


Figure 6: Right techniques by stances except walking, sitting and L stances.

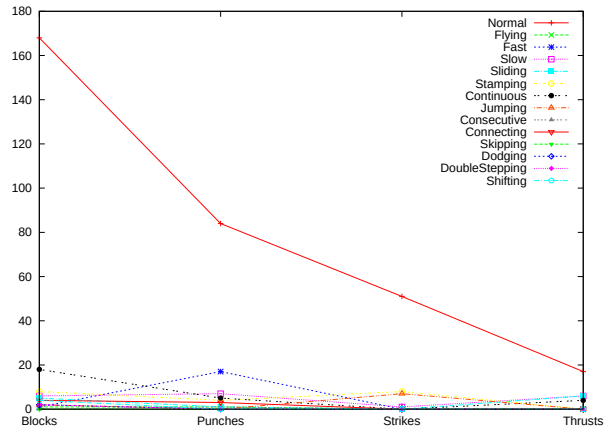


Figure 7: All techniques by all motion types.

used for blocking, punching, striking and thrusting. The parallel stance is only used for punching, whereas the vertical stance is only used for striking. Only blocks are performed in the diagonal stance and the bending ready stance A. Finally, there are no techniques on the left side performed in the vertical stance.

The total number of techniques for both sides is 37 blocks and 34 attacks. Of all techniques on the left side, 59.5 % are blocks, 40.46 % are attacks. This means that there are 19.05 % more blocks than attacks performed on that side. The right side follows the same pattern as the left, with more blocks than attacks. 57.51 % of techniques are blocks and 42.6 % are attacks, meaning that there are 14.91 % more blocks than attacks on the right side.

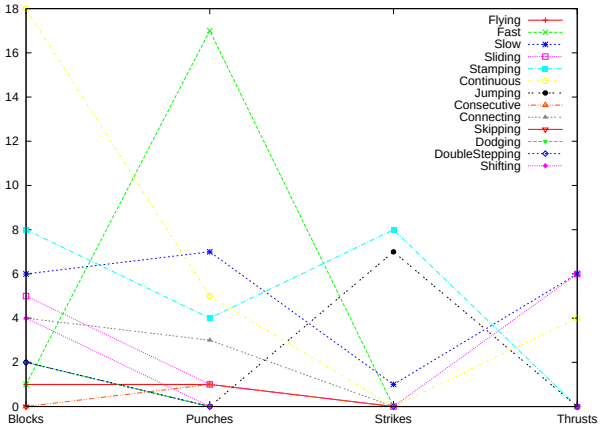


Figure 8: All techniques by motion type except normal motion.

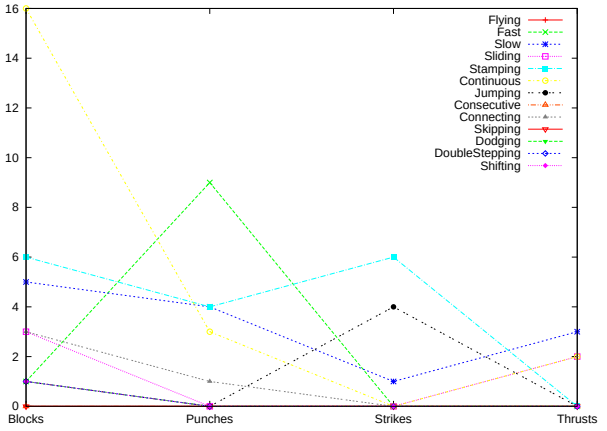


Figure 9: Left techniques by motion type except normal motion.

3.4. Techniques by Motion Type

There are 14 different motion types registered in our data set. The larger part of the techniques (76 %) are performed in normal motion (Figure 7), followed by continuous motion (6 %) and fast motion (4 %).

Excluding normal motion, it is interesting to note the high presence of blocks in continuous motion, which alone amounts to 34 % of blocks performed (Figure 8). Continuing with Figure 8, it shows that there is a high occurence of punches performed in fast motion compared to other motion types.

When examining the number of different motion types to either side, we find that there are more motion types on the right side, than on the left. The right side has flying motion and consecutive motion, in addition to motion types found on the left side. Also, there are more flying, slow, sliding and consecutive

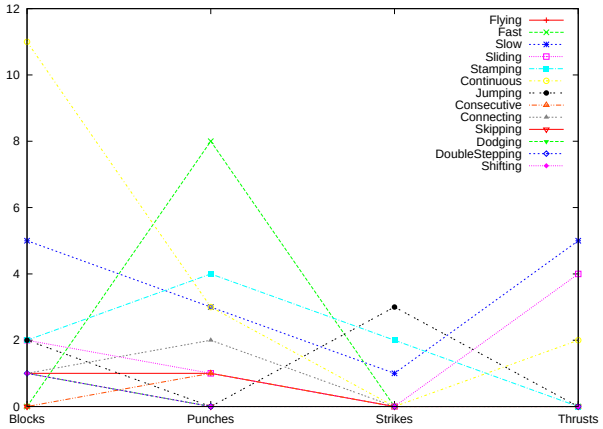


Figure 10: Right techniques by motion type except normal motion.

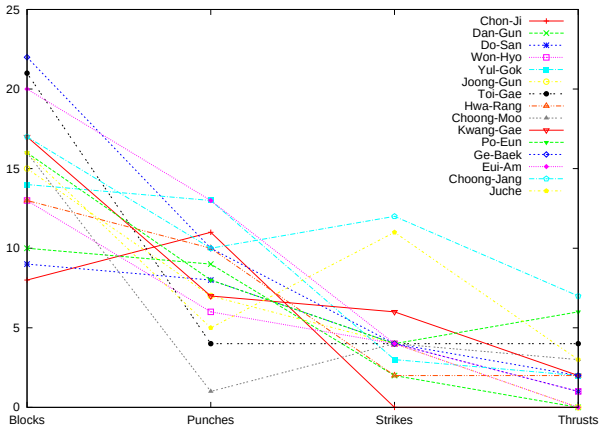


Figure 11: All techniques by patterns.

motions on the right side. However, there are more fast, stamping, continuous and connecting motions on the left side. Comparing the number of motion types on both sides reveals that there are equal amounts of slow, jumping, dodging, double stepping and shifting motions, although with different groups of techniques (Figures 9, 10).

3.5. Techniques by Patterns

With a few exceptions, all techniques by all patterns for both sides, follow the same trend. There are more blocks than punches, more punches than strikes, and more strikes than thrusts (Figure 11). This trend is also true when grouping the patterns by black belt patterns and color belt patterns (Figures 12, 13).

The exceptions for all techniques on both sides are: Chon-Ji (having more punches than blocks), Choong-Moo, Choong-Jang and Juche (with more strikes than

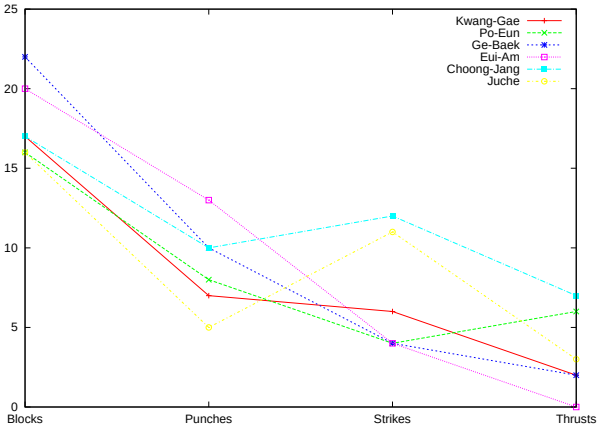


Figure 12: All techniques by black belt patterns.

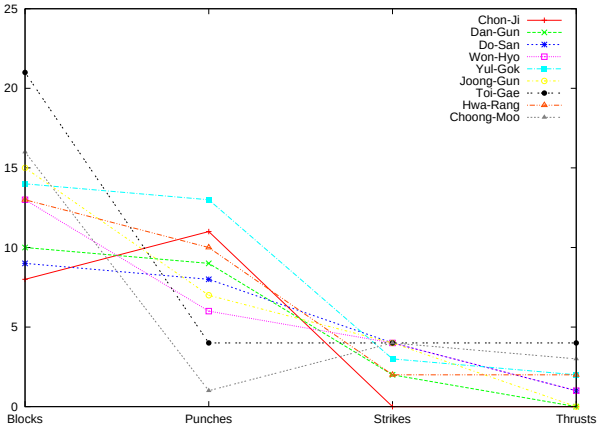


Figure 13: All techniques by color belt patterns.

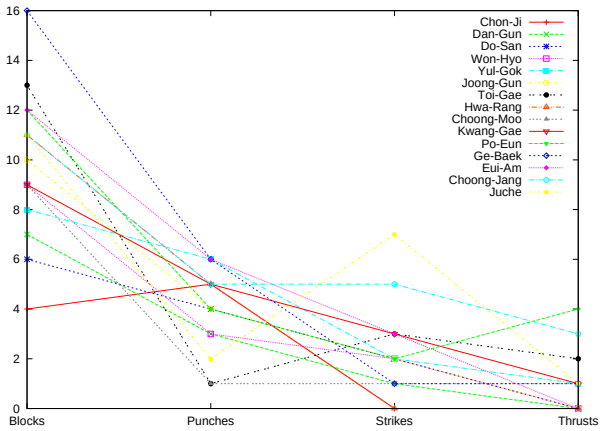


Figure 14: Left techniques by patterns.

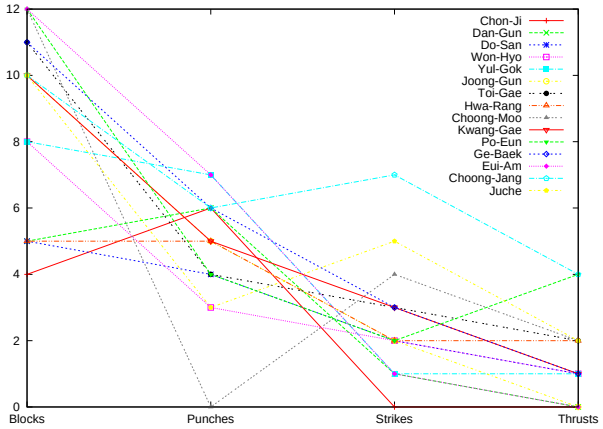


Figure 15: Right techniques by patterns.

punches) and Po-Eun (where there are more thrusts than strikes).

There are, however, patterns which do not follow the exceptions described above (Figures 14, 15). There are, for instance, more punches than blocks in patterns Chon-Ji and Dan-Gun on the right side than there are on the left side. And, when we compare the number of punches to strikes, both Toi-Gae and Choong-Moo have an equal amount of punches and strikes on the left side. Lastly, there is Choong-Jang with more strikes than punches on the right side.

4. Conclusions

There are more hand techniques performed on the right side than on the left side. Thus, there is a bias towards the right side.

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