Ghuluww in *al-Kāfī*: A Data-Analytic Approach

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Abstract

Several academic studies have so far dealt with the concepts of *ghuluww* (to transgress a boundary) in the first five Islamic centuries. In this paper, we develop a data-analytic approach and apply statistical techniques to assess some of the hypotheses inspired by these studies. As a case-study, we examine whether there is any correlation between theological themes found in one of the major Imāmī *ḥadīth* compendia, *al-Kāfī fī ʿilm al-dīn* compiled by Muḥammad b. Yaʿqūb al-Kulaynī (d. 329/941), and those *ḥadīth* transmitters, who are labelled as *ghālī* (transgressive Shīʿī; pl. *ghulāt*) by available Imāmī bio-bibliographical dictionaries of the fourth/tenth and fifth/eleventh centuries. We analyse if there is any content of *ḥadīths*, where the presence or influence of a *ghālī ḥadīth* transmitter significantly exceeds the average found in the entire *al-Kāfī*. Moreover, we investigate whether there exists any content of *ḥadīths*, where the *ghālī*-community (*ghālī*-to/from-*ghālī*) transmission of *ḥadīths* is meaningfully more than the average found in the entire *al-Kāfī*. Our results suggest that, as far as the *isnāds* and *matns* (texts) of *ḥadīths* found in *al-Kāfī* are concerned, there is neither statistically significant presence of *ghālī* transmitters nor *ghālī*-community transmission of what is considered as the *ghālī ḥadīth* genres such as the belief in Shīʿī Imāms' preternatural knowledge of the unseen (*ʿilm al-ghayb*) or supernatural power.

Keywords

Ghuluww - Imāmī *ḥadīth* collections - *al-Kāfī* - data-analytic approach - statistical techniques - Imāmī bio-bibliographical dictionaries.

Introduction

The term *ghuluww*, the use of which possibly dates back to the first/seventh century, means "to transgress a boundary".[1] The focus of this paper is a group of *ḥadīth* transmitters, who were described by the later Imāmī bio-bibliographical dictionaries of the fifth/eleventh century, *Fihrist asmāʾ muṣannifī al-Shīʿa*, which is – albeit mistakenly – known as *Rijāl al-Najāshī*,[2] written by Aḥmad b. ʿAlī al-Najāshī (d. 450/1058) and *Fihrist al-Ṭūsī*[3] by Muḥammad b. al-Ḥasan al-Ṭūsī (d. 460/1067), as *ghālī* (transgressive Shīʿa; pl. *ghulāt*). Some of these *ghālī*-labelled individuals have been among the disciples of Muḥammad b. ʿAlī al-Bāqir (the fifth Shīʿī Imām; d. 114/733) and his son Jaʿfar b. Muhammad al-Ṣādiq (the sixth Shīʿī Imām; d. 148/765). There is a confusion and ongoing discussion, both in the early primary Islamic texts and in the modern academic scholarship on the history of early Islam as to what constitutes *ghuluww* and what are the main theological tenets of *ghulāt*. Analysing the *isnād-* and *matn-* parts of *ḥadīths* included in one of the major Imāmī *ḥadīth* compendia, *al-Kāfī fī ʿilm al-dīn* compiled by Muḥammad b. Yaʿqūb al-Kulaynī (d. 329/941), as a case-study, this paper develops and applies a data-analytic approach to investigate some of the hypotheses inspired by the academic scholarship on the concept of *ghuluww*. It illustrates and provides a means to rigorously address some of the confusion and disagreement in the ongoing historical research.

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[1] Sean W. Anthony suggests "to transgress a boundary", which we also use this terminology in this paper, as the proper English translation of *ghuluww,* which is consistent with not only its Quranic application but also the relativistic use of the term through history. See Sean W. Anthony, "*Ghulāt* (extremist Shīʿīs)", in: *Encyclopaedia of Islam, THREE*, Kate Fleet, Gudrun Krämer, Denis Matringe, John Nawas, Devin J. Stewart (eds.), Consulted online on 30 August 2023 <http://dx.doi.org/10.1163/1573-3912_ei3_COM_27473>. However, in academic studies, the term "*ghuluww*" is translated into English in various ways. Wadād al-Qāḍī considers "extremism" to be an erroneous translation and suggests "exaggeration" as the most correct translation for this term. See Wadād al-Qāḍī, "The development of the term *Ghulāt* in Muslim literature with special reference to the Kaysāniyya", in Etan Kohlberg (ed.), *Shiʿism* (2003): 169-194.

[2] Aḥmad b. ʿAlī al-Najāshī, *Rijāl al-Najāshī* (Qum: Muʾassasat al-Nashr al-Islāmī, 1365 SH).

[3] Muḥammad b. al-Ḥasan al-Ṭūsī, *Fihrist kutub al-Shīʿa wa uṣūlihim wa asmāʾ al-muṣannifīn wa aṣḥāb al-uṣūl*, known as *Fihrist al-Ṭūsī* (Qum: Maktabat al-muḥaqqiq al-Ṭabāṭabāʾī, 1420 AH).

Ghuluww has generally been categorised by Imāmī Shīʿī heresiographers and theologians in diverse beliefs such as the concealment (*al-ghayba*) of the Imām instead of his death, the belief in the return of Imām (*al-rajʿa*), the continuation of divine revelation (*waḥy*) and inspiration (*ilhām*) after the prophet Muḥammad's death, the corruption and suppression of Qurʾān (*taḥrīf*), the Imāms' possession of a preternatural knowledge of the unseen (ʿ*ilm al-ghayb*), the primacy of the esoteric interpretation of the Qurʾān (*taʾwīl*), the transmigration of souls (*tanāsukh*), the inherence of the divine in humans (*ḥulūl*), and the delegation (*tafwīḍ*) of divine powers to the Imāms.[4] Several academic studies have also delved into the history and concept of *ghuluww* during the first five centuries of Islam. As with those Imāmī heresiographers and theologians, an analysis of these works reveals that this concept in the early Islamic era not only is marked by inconsistency but also has mixed connotations of negative and pejorative as well as positive and complimentary.[5] Some important results of these academic works can be summarised as follows:

1. early Shīʿī *ghuluww* was rooted in gnosticism, which implies that early *ghulāt* had distinct views on Imāms, on the body and the soul (*e.g.*, in transmigration of souls and rejecting the day of resurrection) and on legal matters (*e.g.*, on denying the necessity of rituals such as fasts and prayers).[6]

2. The concept of *ghuluww* underwent several transformations and while the-first/seventh-century *ghulāt* merely believed in the concealment and return of their leaders, later these tendencies were acquired by the mainstream community and the term *ghuluww* was used to refer to more extreme ideas that deified the imams.[7]

3. The theological views of early *ghulāt* may be exaggerated in the primary Islamic literature, to distinguish them from the theological tenets that later received wide acceptance from the mainstream community.[8]

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[4] Anthony, "*Ghulāt*", 38.

[5] Ibid., 38.

[6] See, for instance, Heinz Halm, *Die islamische Gnosis. Die extreme Schia und die ʾAlawiten* (Artemis-Verlag, 1982).

[7] See al-Qāḍī, "The development", 169–194.

[8] See, for instance, Marshall G. S. Hodgson, "How Did the Early Shīʿa Become Sectarian?", in *Journal of the American Oriental Society* 75/1 (1955): 1–13.

4. The gnostic theological ideas were ascribed to *ghulāt* at a later stage and there is no historical basis to assume that the early *ghulāt* had such a different theological basis than the mainstream community.[9]

5. During the Imamate of the sixth Shīʿī Imām, Jaʿfar al-Ṣādiq, another group of *ghulāt* emerged, who are referred to as *Mufawwaḍa* and believed that "Imāms were supernatural beings who possessed limitless knowledge, including that of unseen, and had power of disposal over the universe".[10]

As demonstrated and discussed in subsequent sections of this paper, our data analysis approach proposes a ground, which aligns with certain aspects of current academic findings, such as the fourth theory given above. However, and more importantly, it raises questions and potential contradictions, particularly in the context of the fifth theory, which is the primary focus of this research, i.e., the difference between the theological tenets transmitted by *ghulāt* and non-*ghulāt ḥadīth* transmitters. Based on such a distinction, one must assume that certain genres, mostly concerned with the supernatural power and knowledge of Shīʿī Imāms, were clear markers of the *ghālī* tendency and were commonly transmitted among them. We translate this hypothesis into the following two research questions (RQs):

RQ1. Is there a sequence of *ḥadīths* in which the presence/influence of *ghālī* transmitters is meaningfully more than the average of the entire *al-*

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[9] See Tamima Bayhom-Daou, The Imam's Knowledge and the Quran according to al-Faḍl b. Shādhān al-Nīsābūrī (d. 260 A.H./874 A.D.), in *Bulletin of the School of Oriental and African Studies* 64/2 (2001): 188-207; see also idem., "The Second-Century Šīʿite Ġulāt: Were They Really Gnostic?", in *Journal of Arabic and Islamic Studies*, 5:13–61.

[10] Hossein Modarressi, *Crisis and Consolidation in the Formative Period of Shi'ite Islam: Abū Jaʿfar Ibn Qiba Al-Rāzī and His Contribution to Imāmite Shīʿite Thought* (Princeton: Darwin Press, 1993), 21. For some other instances of academic studies on the development and history of *ghuluww*, see M. A. Amir-Moezzi, *The spirituality of Shi'i Islam. Beliefs and practices*, London 2011; Mushegh Asatryan, *Controversies in Formative Shiʿi Islam: The Ghulat Muslims and Their Beliefs* (Bloomsbury, 2016); *idem.*, An early Shīʿi cosmology. *Kitb al-ashbāḥ wa-l-aẓilla* and its milieu, *SI* 110 (2015): 1–80; *idem.*, Shiite underground literature between Iraq and Syria. *The Book of shadows* and the history of the early *ghulāt*, in Y. Tzvi Langermann and Robert G. Morrison (eds.), *Texts in transit in the pre-modern eastern Mediterranean* (Philadelphia 2016): 128-61; Anthony, The legend of ʿAbdallāh ibn Sabaʾ and the date of *Umm al-Kitāb*, *JRAS* 21 (2011): 1–30; *Idem.*, Kaysāniya, *EIr*; *Idem., The caliph and the heretic. Ibn Sabaʾ and the origins of Shiʿism* (Leiden, 2012); *idem.*, The Meccan prison of ʿAbdallāh b. al-Zubayr and the imprisonment of Muḥammad b. al-Ḥanafiyya, in M. A. Pomerantz and A. Shahin (eds.), *The heritage of Arabo-Islamic learning. Studies presented to Wadad Kadi* (Leiden 2015), pp. 3–27; Tamima Bayhom-Daou, The second-century Šīʿite *ghulāt*. Were they really gnostic? *JAIS* 5 (2003–4): 13–61; *idem.*, The imam's knowledge and the Quran according to al-Faḍl b. Shādhān al-Nīsābūrī (d. 260 A.H./874 A.D.), *BSOAS* 64 (2001): 188–207; Patricia Crone, *The nativist prophets of early Islamic Iran. Rural revolt and local Zoroastrianism*, Cambridge 2012; Patricia Crone, The significance of wooden weapons in the revolt of al-Mukhtār and the Abbasid revolution, in Ian Richard Net- ton (ed.), *Studies in honour of Clifford Edmund Bosworth* (Leiden 2000), 1:174–85; Amikam Elad, *The rebellion of Muammad al-Nafs al- Zakiyya in 145/762* (Leiden: Brill, 2016).

Kāfī? (The concept of "sequence" in this paper refers to a fixed number of neighbouring *ḥadīths*; the concept of sequence is used here to avoid dependence on *al-Kāfī's* variable-length chapters (*kitābs*). The influence of the *ghālī*-labelled *ḥadīth* transmitters is measured by quantifying the number of *ḥadīths*, in whose *isnāds* there is at least one *ghālī*.)

RQ2. Is there a sequence of *ḥadīths*, in which the *ghālī*-community transmission (*ghālī*-to/from-*ghālī* transmission) of *ḥadīth* among *ghulāt* is meaningfully more than the average of the entire *al-Kāfī*? (We assess the impact of *ghālī*-community *ḥadīth* transmission by examining the *isnāds*, comparing those in which a *ghālī* transmits from another *ghālī* transmitter with those where non-*ghālī* transmitters transmit from *ghālī* transmitters.)

First, this paper specifies and details our methodology and the design of our experiments. Second, it elaborates the design of our data-analytic statistical experiments and discusses its results.[11] Third, it carefully studies the distinctive examples of the data-analytic results through manual-critical scrutiny, which indeed closes the loop of our human-in-the-loop data-analytic methodology, to show how the data-analytic approach and statistical techniques applied in this paper can lead an Islamic Studies expert to the more refined research questions and new ideas for future data-analytic experiments. Finally, the potential threats to the validity of our results and the measures we take to mitigate them are extensively examined.

Methodology and Experiment design

Our research methodology comprises the following four steps:
1. Digitising the information and building a database on those *ḥadīth* transmitters labelled as *ghālī* by Imāmī bio-bibliographical dictionaries: To verify the digitised data we did two independent rounds of encoding and cross-checked the two to remove any incomplete information or inaccuracy regarding these *ghālī* transmitters (For the list of *ghālī* transmitters in *al-Kāfī*, see Appendix). We compiled a list of these transmitters, including their various designations, links to the texts

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[11] For the sake of reproducibility and for future use, we have made a lab package comprising the data and software used in our research available at the following address: https://github.com/ghuluwwproj/alkafi.

documented in four significant Imāmī bio-bibliographical dictionaries such as *Rijāl al-Najāshī*, *Fihrist al-Ṭūsī*, *Rijāl al-Ṭūsī*[12] written by Ṭūsī, and *Ikhtīyār maʿrifat al-rijāl*[13], which is Ṭūsī's abridgment of *Rijāl al-Kashshī* compiled by Muḥammad b. ʿUmar al-Kashshī (d. c. 340/951).[14]

2. Digitising and building a database on *isnāds* included in *al-Kāfī* to identify the transmitters in each *isnād*: We spent substantial manual effort cleaning up the *isnāds* and particularly disambiguating the names of accused *ghālī* transmitters appearing in the *isnāds* of *al-Kāfī*. We removed those *isnāds* which cannot be further used in our analysis: sometimes after a particular *isnād*, al-Kulaynī relates the same *ḥadīth* from another Imām, without quoting its *isnād*. In these cases, the second truncated *isnād* has been removed, i.e., 818 cases out of 16145 total cases.

3. Designing and performing experiments to identify those sequences/chapters/contents, the transmission of which solely depends on the presence of a *ghālī ḥadīth* transmitter, which we refer to here as '*ghālī*-intensive sequences/chapters/contents', and to examine *ghālī*-community transmission: We design six different metrics, which are discussed in the next section, to determine the highest *ghālī*-intensive and *ghālī*-community chapters in *al-Kāfī*.

4. Applying human-in-the-loop methodology: We delve into and examine two *ghālī*-intensive chapters of *al-Kāfī*, offering an illustrative example of a human-in-the-loop methodology. This shows how the collaboration and involvement of a human expert in such research can improve the data analytics process, and most significantly, come up with more refined and nuanced questions.

Our goal is to identify the sequence/sequences of *ḥadīths* that essentially rely on or intensively transmitted by *ghālī*-labelled transmitters. To develop our data-analytic approach to determine these sequences, we divide them into two types, which respectively refer to RQ1 and RQ2: (1) *ghālī*-intensive sequences; and (2) *ghālī*-community-transmission sequences. We use the concept of

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[12] Ṭūsī, *Rijāl al-Ṭūsī* (Qum: Muʾassasat al-Nashr al-Islāmī, 1373 SH).

[13] Ṭūsī, *Ikhtīyār maʿrifat al-rijāl* (Qum: Muʾassasat āl al-bayt li-iḥyāʾ al-turāth, 1404 AH).

[14] There is another Imāmī bio-bibliographical dictionary known as *Rijāl Ibn al-Ghaḍāʾirī*, which we have excluded from our data analysis due to historical uncertainties regarding its authorship. However, in the section addressing the threats to the validity of our findings, we later include this bio-bibliographical dictionary and present the results for both of our research questions (RQ1 and RQ2) in Figures 6 and 7.

sequence as a proxy to the semantically-related *matn*. A *ḥadīth* can be found within a certain number of sequences both to its right and left. The only exceptions to this rule are the *ḥadīths* located at the beginning or at the end of *al-Kāfī*. For instance, when considering a sequence length W=4, a *ḥadīth* appears in a maximum 4 sequences if its distance from the beginning or the end of *al-Kāfī* is more than 4 *ḥadīths*, and at least, in 1 sequence if it is the very first or last *ḥadīth* in *al-Kāfī* (see Figure 1).

1	2	3	4	5	6	7	8	9	10	…	N
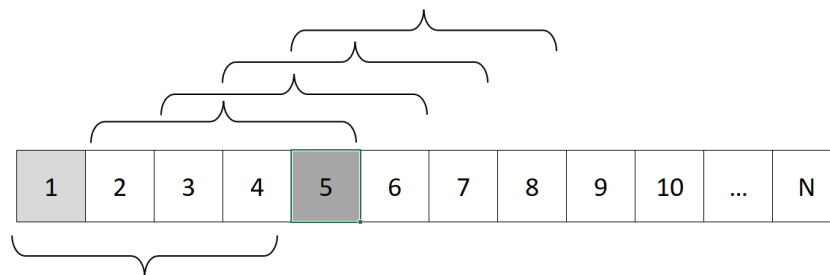
Figure 1. Sequence length (W=4)

RQ1

For RQ1, which is to identify *ghālī*-intensive sequences, experiments are conducted with sequence lengths W=20 and W=40. Figure 2 shows the percentages corresponding to the sequences sliding over *al-Kāfī*. The sequence lengths W=20 and w=40 are respectively depicted in blue and red.
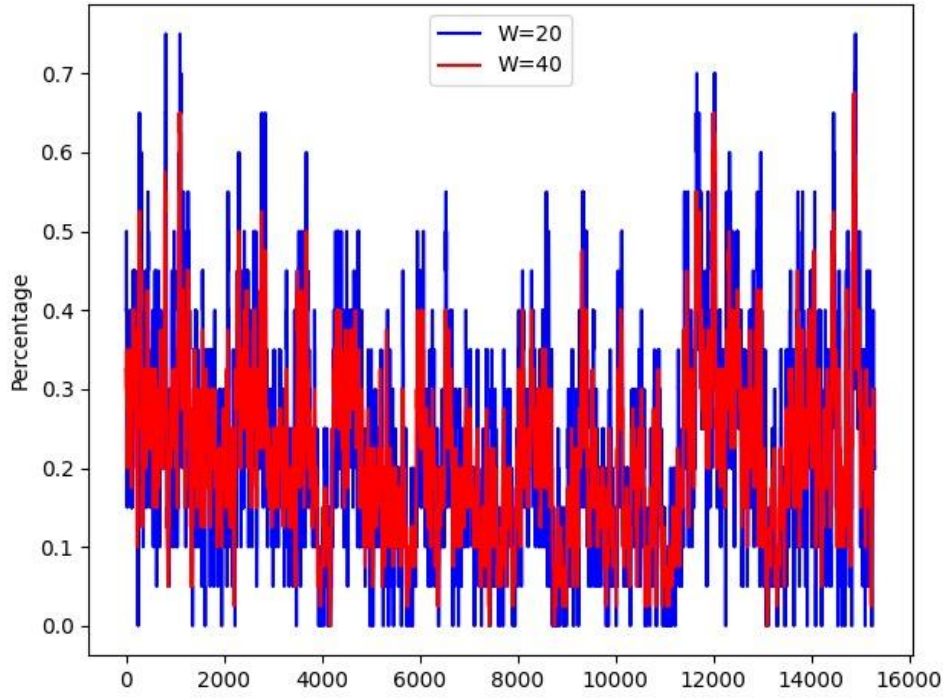
Figure 2. Average presence of *ghālī* transmitters in *al-Kāfī* for sequence lengths W=20 and W=40

Since each *ḥadīth* is found in multiple sequences, and each of these sequences is associated with a specific percentage, each *ḥadīth* corresponds to a collection of percentages. These percentages enable us to quantitatively compare the influence of *ghālī*-labelled *ḥadīth* transmitters in *al-Kāfī*. We use statistical tests of significance[15] to ascertain whether any observed differences are substantial or merely the result of chance. Statistical tests of significance address this question by quantifying the probability (p-value) of observing the difference, assuming there is no meaningful difference (null hypothesis). When p-value is very small, typically below a threshold taken as 0.05 or 0.01 in statistics, the null hypothesis is rejected, which suggests that there is evidence against the null hypothesis, and it should be rejected in favour of an alternative hypothesis. Considering this, we compare the distributions of *ghulāt* in a set of sequences belonging to each *ḥadīth* with the overall distribution of *ghulāt* across all sequences in *al-Kāfī*. For each set of sequences of a particular *ḥadīth*, the null hypothesis assumes that the distributions of *ghālī* transmitters in this set is the same as the distribution of *ghulāt* in the entire *al-Kāfī*'s sequences. We use

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[15] Statistical tests of significance are employed to gauge the likelihood that an observed relationship in the data is solely the result of chance, indicating the probability that the variables are genuinely unrelated within the population.

Mann–Whitney U-test[16] to assess statistical tests of significance, using the threshold of 0.05.

We employ Cliff's Delta[17] to assess the effect sizes[18], which basically measure the strength of differences between these sets of sequences, to determine the sets of sequences as *ghālī*-intensive, when the p-value is less than 0.05 and Cliff's delta exceeds 0.474 (an effect size larger than 0.474 is typically taken as a strong effect in statistics).[19] As each particular set of sequences linked with *ḥadīth*, all *ḥadīths* found in *al-Kāfī* can then be arranged and ranked based on these effect sizes, and therefore, top 1000, 2000, and 3000 *ḥadīths* can be selected. This enables us to identify the chapters that contain these *ḥadīths*, ranking them based on their normalised frequency. Figure 3 provides a more coherent view on differences between the top ten *ghālī*-intensive chapters, when using the proposed six different metrics (top 1000 *ḥadīths* (W=20), top 2000 *ḥadīths* (W=20), top 3000 *ḥadīths* (W=40), top 1000 *ḥadīths* (W=40), top 2000 *ḥadīths* (W=40), top 3000 *ḥadīths* (W=40)).

RQ2

To address RQ2, which is to examine *ghālī*-community-transmission sequences in *al-Kāfī*, three steps are followed:

1. As with RQ1, we again calculate a new percentage for each sequence, specifically the percentage of *ghālī*-to/from-*ghālī*-transmission links found in the *isnāds* included in this sequence. We identify *ḥadīths*, whose corresponding list of percentages significantly and "strongly" exceeds the average of *al-Kāfī*, as illustrated in Figures 4 and 5.

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[16] The Mann–Whitney U-test is a nonparametric test assessing the null hypothesis that, for randomly selected values X and Y from two populations, the probability of X being greater than Y is equivalent to the probability of Y being greater than X.

[17] To assess potential differences in scores, Cliff's Delta is employed for comparison. This statistic was selected for several reasons, primarily because it serves as an effect size with a significance value, and it was specifically designed for ordinal data (which aligns with the data type present in the AES), making it a non-parametric option.

[18] In statistics, an effect size is a measure that quantifies the magnitude of the relationship between two variables within a population or provides an estimate of that measure based on a sample.
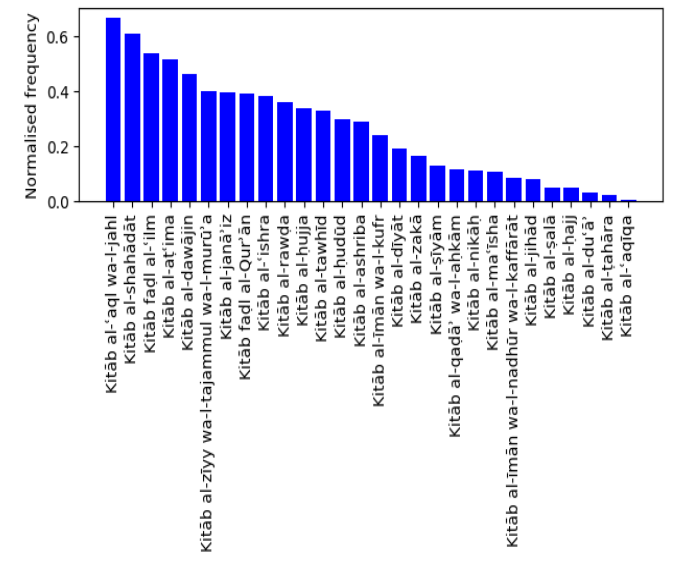
[19] To know more on the statistical methods, we use in this paper, see for instance, Verma, J. P., Abdel-Salam, Abdel-Salam G. Testing Statistical Assumptions in Research. United Kingdom: Wiley, 2019.
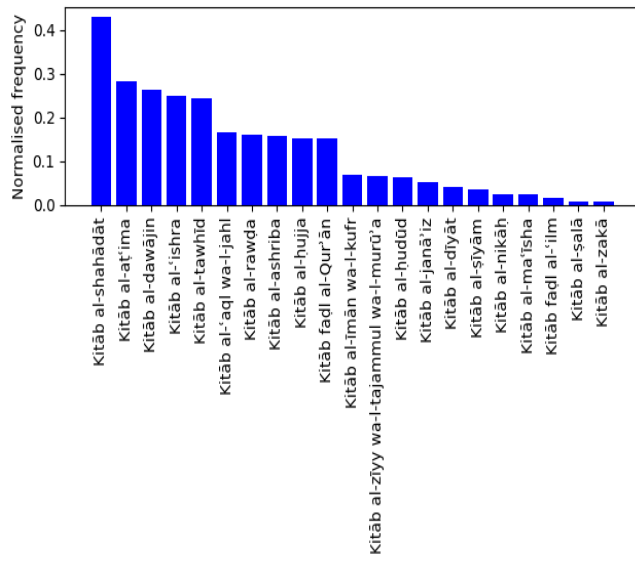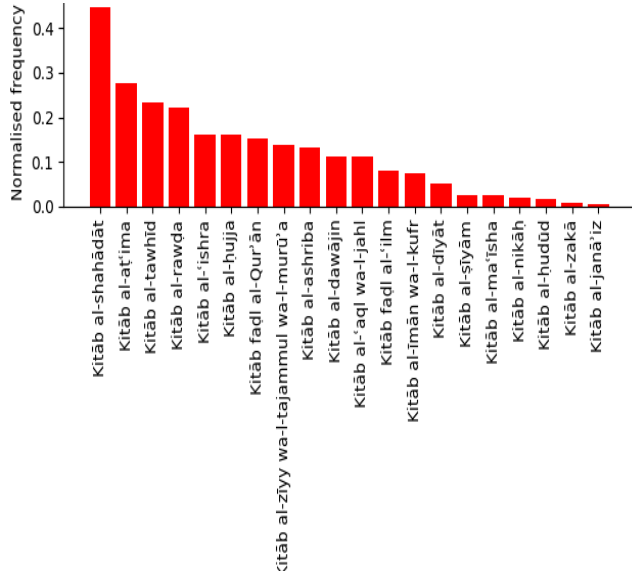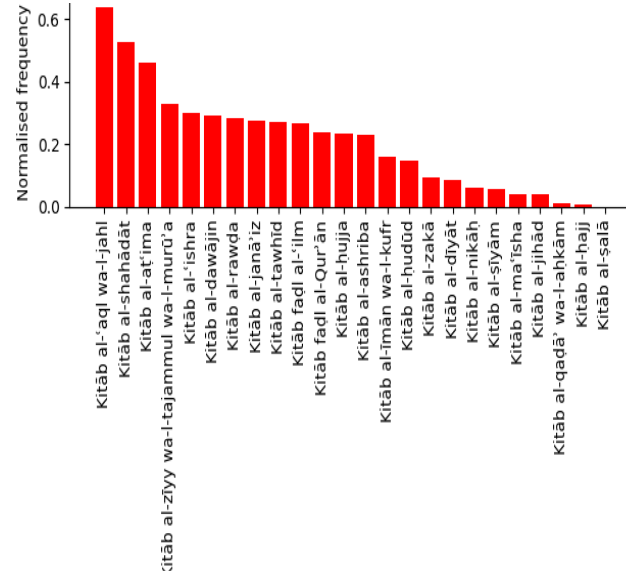
Top 1000 ḥadīths (W=20)
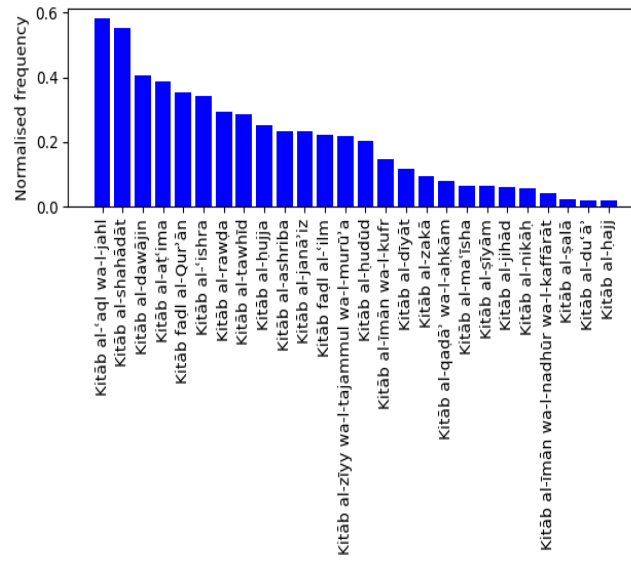
Top 2000 ḥadīths (W=20)

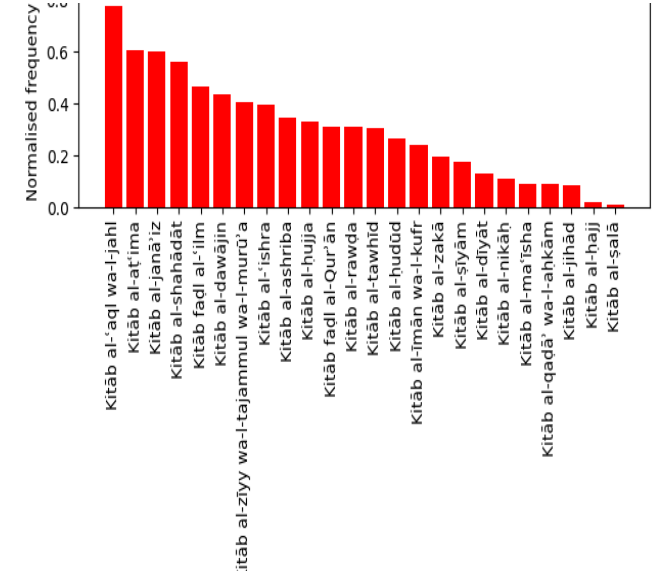Top 3000 ḥadīths (W=20)

Top 1000 ḥadīths (W=40)

Top 2000 ḥadīths (W=40)

Top 3000 ḥadīths (W=40)

Figure 3. RQ1

Top 1000 ḥadīths (W=20)

Top 2000 ḥadīths (W=20)

Top 3000 ḥadīths (W=20)

Top 1000 ḥadīths (W=40)

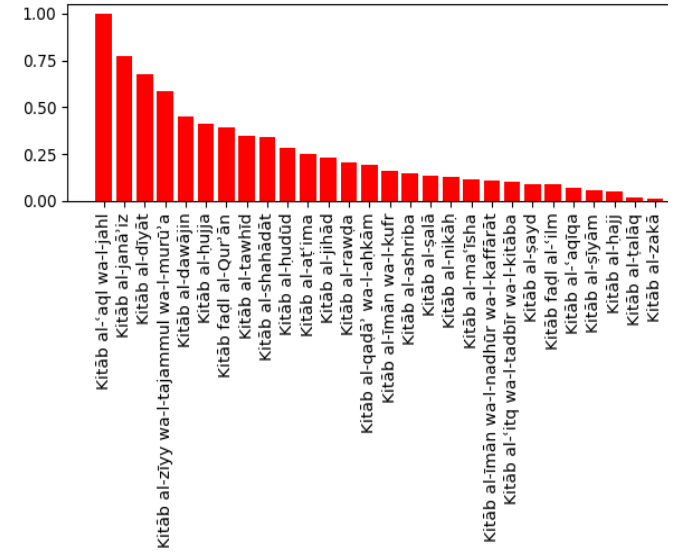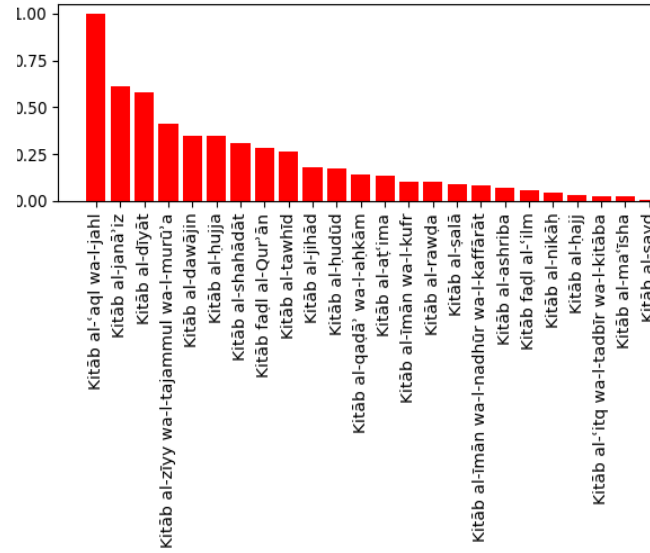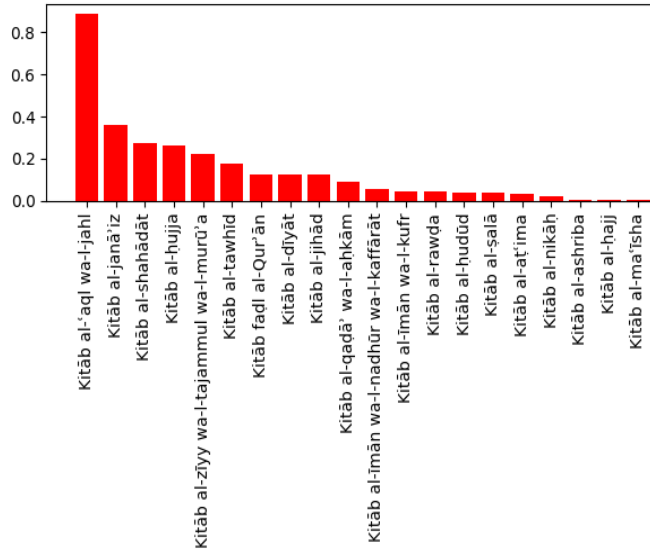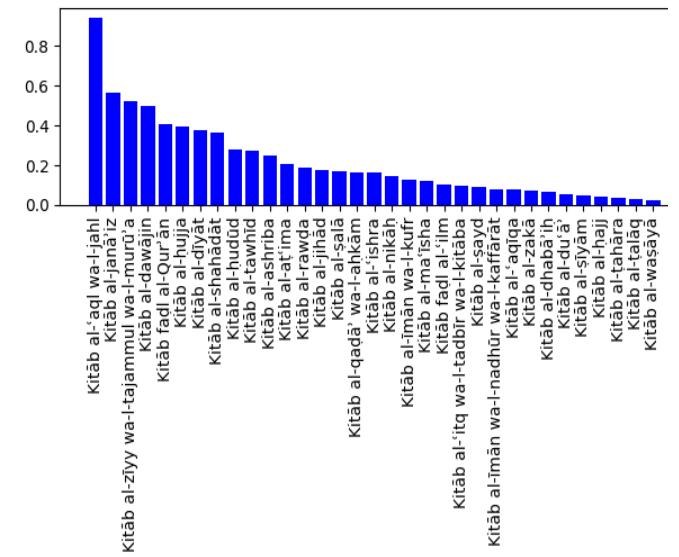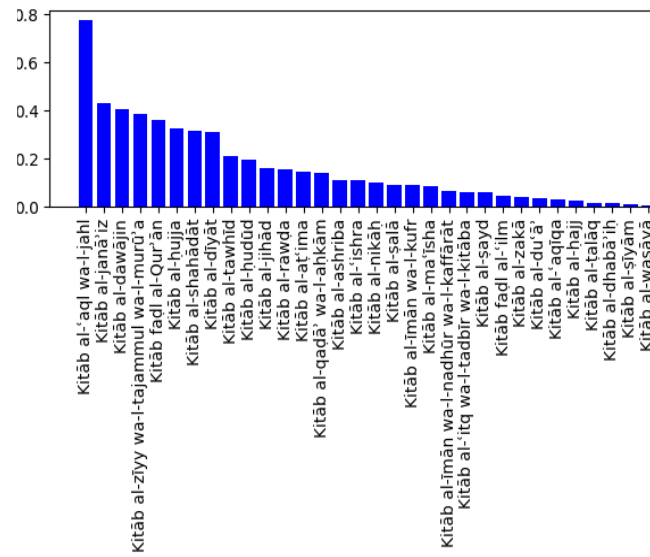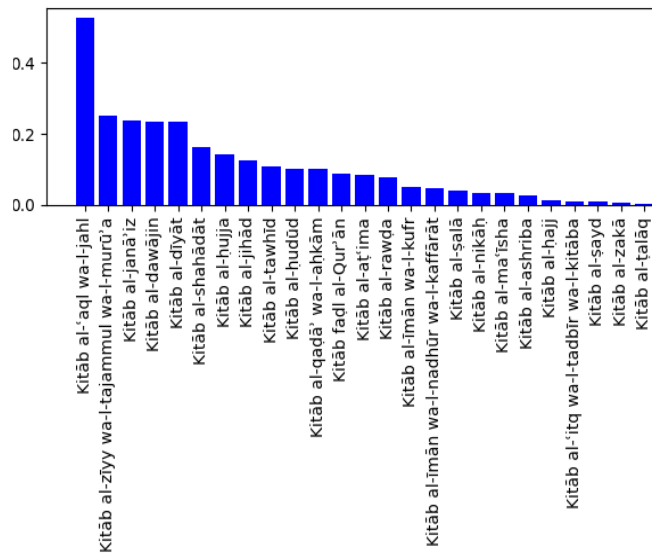Top 2000 ḥadīths (W=40)

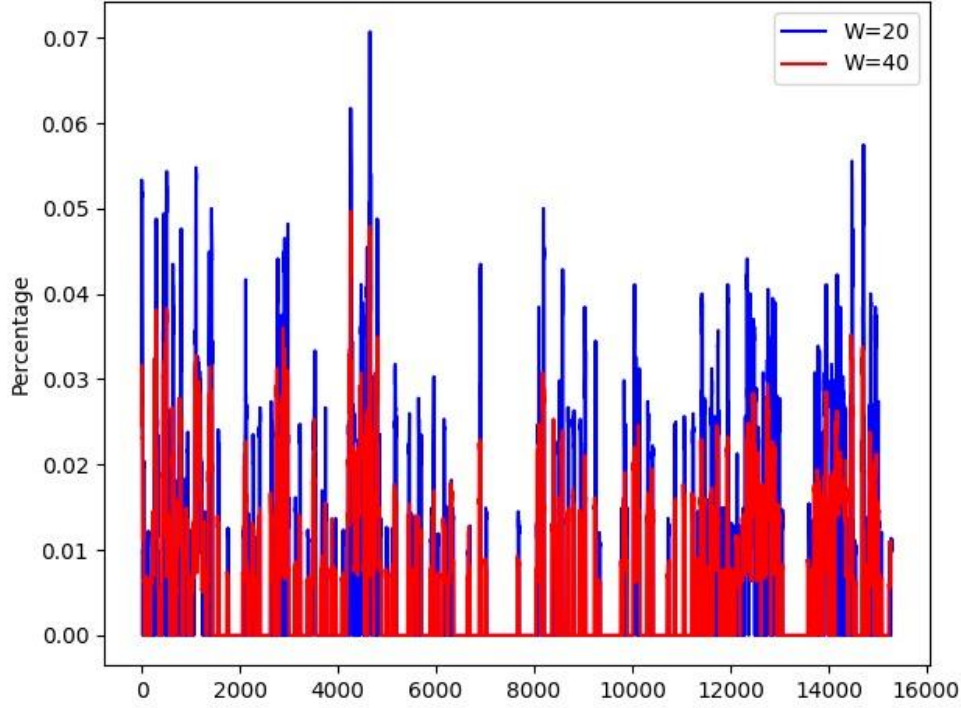Top 3000 ḥadīths (W=40)

Figure 4. RQ2

Figure 5. Average presence of *ghālī*-community-transmission links across *al-Kāfī*.

2. To further explore *ghālī*-community-transmission sequences, we investigate the influence of two *ghālī* individuals transmitting *ḥadīth* to/from each other. We consider a link in an *isnād* with the pair (u, v), where u and v are *ḥadīth* transmitters. We compare the probability of u and v both being *ghālī* with that of u not being *ghālī*, while v is labelled as *ghālī*. In other words, we examine the statistical dependence between u and v both being *ghālī* and the situation where v is *ghālī* while u is not. To this end, we use the Chi-squared test. [20] The results indicate that a p-value of $4e^{-15}$ and an effect size index, denoted as w, of 0.07, which is considered a small effect as it is less than 0.1.

3. For this step, all top 1000 *ḥadīths* resulted from RQ1 are considered. Taking their *isnāds* into account, we extract those *ḥadīths*, in the *isnāds* of which a *ḥadīth* transmitter is narrating from a *ghālī*. It is examined in how many cases this *ḥadīth* transmitter is himself *ghālī*. The same process is repeated for the entire *al-Kāfī*. Then, the results are compared. Again, the Chi-squared test is used, resulting in a p-value of 0.884. As the p-value is

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[20] A chi-squared test is a statistical hypothesis test employed for the analysis of contingency tables when dealing with large sample sizes. In simpler terms, this test is primarily used to determine whether two categorical variables are statistically independent factors influencing the test statistic.

more than 0.05, the null hypothesis cannot be rejected, which implies that no meaningful or useful insights can be drawn from the results. This means that for each *ghālī*-intensive chapter, community transmission (*ghālī*-to/from-*ghālī*) among all bio-bibliographically labelled *ghulāt* is not necessarily more significant and *ghulāt* have been engaged with various theological subjects in a statistically homogenous manner.

The results of RQ1 and RQ2 can respectively be seen below in Tables 1 and 2. Each table features one row for each chapter, and six columns, showing the ranking of this chapter according to the six different metrics employed for each research question. These metrics encompass two different sequence lengths (W=20 and W=40), for each of which three groups of top-ranking *ḥadīths* (i.e., 1000, 2000, 3000) are provided. The mean rank of each chapter provides a numerical ranking of that chapter among all 10 top chapters. This means that, for instance, *Kitāb al-shahādāt* (the book of testimonies) has the highest number of *ghālī*-intensive sequences and *Kitāb al-ʿaql wa-l-jahl* (the book of intellect and ignorance) has the highest number of *ghālī*-community-transmission sequences comparing to the other chapters of *al-Kāfī*. These two tables serve as an initial summary of our results and can be considered entry points for experts in Islamic Studies to further scrutinise them, pose new research questions, and refine methodologies to obtain more rigorous results.

Chapter	W=20, Top 1000	W=20, Top 2000	W=20, Top 3000	W=40, Top 1000	W=40, Top 2000	W=40, Top 3000	Mean Rank
Kitāb al-shahādāt	1.0	2.0	2.0	1.0	2.0	4.0	2.0
Kitāb al-aṭʿima	2.0	4.0	4.0	2.0	3.0	2.0	2.8
Kitāb al-ʿaql wa-l-jahl	6.0	1.0	1.0	11.0	1.0	1.0	3.5
Kitāb al-dawājin	3.0	3.0	5.0	10.0	6.0	6.0	5.5
Kitāb al-ʿishra	4.0	6.0	9.0	5.0	5.0	8.0	6.2
Kitāb al-rawḍa	7.0	7.0	10.0	4.0	7.0	12.0	7.8
Kitāb al-tawḥīd	5.0	8.0	12.0	3.0	9.0	13.0	8.3
Kitāb al-zīyy	12.0	13.0	6.0	8.0	4.0	7.0	8.3
Kitāb faḍl al-Qurʾān	10.0	5.0	8.0	7.0	11.0	11.0	8.7
Kitāb al-ḥujja	9.0	9.0	11.0	6.0	12.0	10.0	9.5

Table 1. Top ten *ghālī*-intensive chapters of *al-Kāfī*

Chapter	W=20, Top 1000	W=20, Top 2000	W=20, Top 3000	W=40, Top 1000	W=40, Top 2000	W=40, Top 3000	Mean Rank
Kitāb al-ʿaql wa al-jahl	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Kitāb al-janāʾiz	3.0	2.0	2.0	2.0	2.0	2.0	2.2
Kitāb al-zīyy	2.0	4.0	3.0	5.0	4.0	4.0	3.7
Kitāb al-dīyāt	5.0	8.0	7.0	8.0	3.0	3.0	5.7
Kitāb al-ḥujja	7.0	6.0	6.0	4.0	6.0	6.0	5.8
Kitāb al-shahādāt	6.0	7.0	8.0	3.0	7.0	9.0	6.7
Kitāb faḍl al-Qurʾān	12.0	5.0	5.0	7.0	8.0	7.0	7.3
Kitāb al-tawhid	9.0	9.0	10.0	6.0	9.0	8.0	8.5
Kitāb al-jihād	8.0	11.0	14.0	9.0	10.0	12.0	10.7
Kitāb al-ḥudūd	10.0	10.0	9.0	14.0	11.0	10.0	10.7

Table 2. Top ten *ghālī*-community-transmission chapters of *al-Kāfī*

Human-In-The-Loop: Two *Ghālī*-Intensive Chapters of *al-Kāfī*

A vital part of our research is to investigate how the data-analytic approach and statistical techniques in this paper can assist Islamic Studies scholars to arrive at new insights and more refined methodologies and research questions. In other words, we would like to study how the involvement of an Islamic Studies expert in this data-driven process contributes to achieving more comprehensive and insightful results. To this end, we choose two of the top-ten *ghālī*-intensive chapters, *Kitāb al-shahādāt* (ranked one in Table 1) and *Kitāb al-ḥujja* (ranked ten in Table 1, chosen due to the context of Islamic Studies scholarship, discussed below) and studied them in great depth.

Kitāb al-shahādāt

This chapter, comprising 23 *bābs*, generally deals with the laws of testimony and witnessing. Applying the same process on determining and ranking the highest *ghālī*-intensive chapters, a closer examination of *Kitāb al-shahādāt* reveals its following three highest *ghālī*-intensive sections: 1) the section on the witnesses who are rejected (*Bāb mā yuraddu min al-shuhūd*), 2) the section on that which is acceptable of the testimony of women and that, which is not acceptable (*Bāb mā yajūz min shahādat al-nisāʾ wa mā lā yajūz*), and 3) the section on the testimony of other nations (*Bāb shahādat ahl al-milal*). A careful reading of these three sections shows that the *ghālī*-labelled *ḥadīth* transmitters, who are transmitted a significant number of *ḥadīths*, are Sahl b. Zīyād (d. c. 255/869) and Muḥammad b. ʿĪsā b. ʿUbayd, both of whom were active during the first half of the third/ninth century.

It is reported that Sahl b. Zīyād initially resided in Qum, a city with a strong Shīʿī community led by the Ashʿarīs. The Ashʿarīs maintained a delicate political relationship with the neighbouring Sunnī stronghold, Ray, which required their vigilance. Aḥmad b. Muḥammad b. ʿĪsā, the leader of the Ashʿarīs, accused Sahl of being *ghālī*, resulting in Sahl b. Zīyād's exile to Ray.[21] He continued to live in exile in Ray for the remainder of his life, subject to constant scrutiny by the Sunnī political authorities. This situation relieved Ashʿarīs' concerns about their association with him. Furthermore, Sahl b. Zīyād is credited by *Rijāl al-Najāshī*

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[21] See Andrew J. Newman, *The Formative Period of Twelver Shīʿism: Ḥadīth as Discourse between Qum and Baghdad* (UK: Curzon, 2000), 12-31.

as the compiler of a book named '*al-Nawādir*', which interestingly was also transmitted by al-Kulaynī, the compiler of *al-Kāfī*.[22] This might explain the frequent and significant presence of Sahl's transmitted *ḥadīths* in *al-Kāfī*.

Further discussion could also explore the high presence of Muḥammad b. ʿĪsā b. ʿUbayd in *Kitāb al-Šahādāt* as an active *ḥadīth* transmitter. In many of the *ḥadīths* in this chapter, which are transmitted by Muḥammad b. ʿĪsā b. ʿUbayd, he narrates a *ḥadīth* from his teacher, Yūnus b. ʿAbd al-Raḥmān (d. c. 208/823), a famous Imāmī *ḥadīth* transmitter. Muḥammad b. ʿĪsā is recognised as one of the main transmitters of Yūnus b. ʿAbd al-Raḥmān's books to the subsequent generations. Furthermore, there is a lack of consensus among Imāmī bio-bibliographical dictionaries regarding whether Muḥammad b. ʿĪsā b. ʿUbayd should be classified as a *ghālī*. For instance, *Rijāl al-Najāshī* portrays him as a reliable and trustworthy transmitter, attributing to him various theological and legal writings allegedly transmitted by several renowned non-*ghālī ḥadīth* transmitters.[23] However, *Fihrist al-Ṭūsī* suggests that he might be a *ghālī* (*wa qīla innahū yadhhab madhhab al-ghulā*).[24] This discrepancy is one of the potential "threats to validity" in the results of our data-analytic approach, as discussed in the following section. Therefore, since Sahl was labelled as a *ghālī* due to certain socio-political discussions in Qum and given that Muḥammad b. ʿĪsā b. ʿUbayd primarily transmits earlier works and *ḥadīths*, or that he is not conclusively classified as a *ghālī* by Imāmī bio-bibliographical dictionaries.

This information would open the door for an Islamic Studies expert to conduct more in-depth analyses and pose more questions about the correlation between the contents a particular *ghālī* transmitted and his being labelled as *ghālī*. For instance, one may want to analyse whether the sub-community of *ghālī*-labelled transmitters, which can be identified in this context of the socio-political tensions in Qum during the third/ninth and fourth/tenth centuries, held specific theological stances that made them subject of the *ghālī* label. It would also be interesting to find out how the outcomes of RQ1 and RQ2 will change when applied to this sub-community compared to the rest of *ghālī* community excluding them.

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[22] See Najāshī, *Rijāl al-Najāshī*, 185. For the extensive discussion of the written transmission of Imāmī *ḥadīth*, see Mostafa Movahedifar, The Origins of Imāmī *Ḥadīths*: A Bio-bibliographical cross-reference analysis, PhD dissertation, University of Birmingham, 2023.

[23] Najāshī, *Rijāl al-Najāshī*, 333.

[24] Ṭūsī, *Fihrist*, 402.

Kitāb al-ḥujja

This chapter, which comprises about 130 sections, is the most voluminous chapter of *al-Kāfī*.[25] It covers a wide range of theological topics, including, among others, subjects on the necessity of the presence of divine authority among the people, the categories of the prophets, messengers and the Imāms, knowing an Imām and belief in his divine authority, the obligation to obey the Imāms, the aspects of the knowledge of the Imāms, the virtues of Shīʿī Imāms and their primordial existence and role. *Kitāb al-Ḥujja* is ranked 10th among the top ten *ghālī*-intensive chapters, and 5th among *ghālī*-community-transmission chapters (see Tables 1 and 2). This means that, contrary to some academic scholars who identify the contents included in this chapter as the theological tenets of *ghuluww*, based on our data analysis and statistical techniques, *Kitāb al-Ḥujja* is not the most *ghālī*-intensive chapter, neither does it feature the highest amount of *ghālī*-community-transmission. Given the importance of *Kitāb al-Ḥujja* in the context of historical studies on *ghuluww* and for the sake of future further studies on this subject, the top ten *ghālī*-intensive sections, listed from highest to lowest, are presented below:

1. Section that contains points and issues related to the revelations concerning the spiritual authority (*walāya*) of Shīʿī Imāmī (*Bāb fīh nukat wa nutaf min al-tanzīl fī l-walāya*).
2. Section on the indication and the explicit mention of Mūsā b. Jaʿfar al-Kāẓim (the seventh Shīʿī Imām; d. 183/799) as proof of his divine authority) (*Bāb al-ʾishārat wa-l-naṣṣ ʿalā Abī al-Ḥasan Mūsā*).
3. Section on the indication and the explicit mention of ʿAlī b. Mūsā al-Riḍā (the eighth Shīʿī Imām; d. 203/818) as proof of his divine authority (*Bāb al-ʾishārat wa-l-naṣṣ ʿalā Abī al-Ḥasan al-Riḍā*).
4. Section on the birth of the Prophet Muḥammad and his passing away (*Bāb mawlid al-nabī wa wafātih*).
5. Section on the indication and the explicit mention of Muḥammad b. ʿAlī al-Jawād (the ninth Shīʿī Imām; d. 220/835) as proof of his divine authority (*Bāb al-ʾishārat wa-l-naṣṣ ʿalā Abī Jaʿfar al-Thānī*).

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[25] See Kulaynī, *al-Kāfī*, 1:168-548.

6. Section on the Issue that the earth at no time is without a person with divine authority (*Bāb ʾanna al-arḍ lā yakhlū min ḥujja*).

7. Section on the birth of ʿAlī al-Riḍā (*Bāb mawlid Abī al-Ḥasan al-Riḍā*).

8. Section on the extracted and comprehensive narrations regarding walāya (*Bāb fīh nutaf wa jawāmiʿ min al-riwāya fī l-walāya*).

9. Section on the birth of Mūsā al-Kāẓim (*Bāb mawlid Abī al-Ḥasan Mūsā b. Jaʿfar*).

10. Section on the birth of Jaʿfar al-Ṣādiq (*Bāb mawlid Abī ʿAbd Allāh Jaʿfar b. Muḥammad*).

The first of these ten sections, which provides 92 *ḥadīths* on the revelations concerning *walāya*, *ghulāt*, from whom Kulaynī narrates several *ḥadīths*, are ʿAlī b. Ḥassān al-Hāshimī, Muḥammad b. Fuḍayl al-Ṣayrafī, and Muḥammad b. Sinān al-Zāhirī, Muḥammad b. Ūrama. This information allows for a more in-depth examination of the *ḥadīths* transmitted by these individuals. For instance, ʿAlī b. Ḥassān al-Hāshimī, who is only the transmitter of 35 *ḥadīths* in the entire *al-Kāfī*, is found in the *isnāds* of 10 *ḥadīths* in this section. He transmits all these 10 *ḥadīths* from ʿAbd al-Raḥmān b. Kathīr, to whom both *Rijāl al-Najāshī* and *Fihrist al-Ṭūsī* ascribe several books on various topics.[26] Interestingly, the primary transmitter of these books to the next generations is ʿAlī b. Ḥassān. However, the question of authorship and historical authenticity for this purported book needs to be settled in a future study.

Similar to the previous examined chapter of *al-Kāfī*, the insight gained by the data analytics about and the manual-critical scrutiny of *Kitāb al-ḥujja* can lead to more refined studies. One can identify a different sub-community of *ghālī*-labelled transmitters (probably centring around the second/eighth – third/ninth century in Baghdad. Characterising this sub-community and investigating their ideas, while contrasting them with the theological ideas and contents transmitted by the other accused *ghālī* transmitters can be the subject of a second iteration of a data analytic study.

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[26] Najāshī, *Rijāl*, 234-35.

Threats to the Validity

This section discusses five threats to the validity of our methodology and findings. Such reflections are common practice in the empirical (computer) science literature and may not seem typically in a paper in the humanities, especially in the field of Islamic Studies. However, recognising these threats and understanding how to mitigate them would be crucial for informing potential future applications of the same data-analytic approach and for extending the scope of this paper to encompass other Imāmī and non-Imāmī *ḥadīth* collections.

1) Influence of specific Imāmī bio-bibliographer: It is arguable that relying upon a particular Imāmī bio-bibliographical work may influence the reliability of the results and pose a threat to generalising a comprehensive theory on the concept and history of *ghuluww*. To address this issue, we have included four different bio-bibliographical sources, *Rijāl al-Najāshī, Fihrist al-Ṭūsī, Rijāl al-Ṭūsī*, and *Rijāl al-Kashshī*, compiled by various Imāmī scholars, some of whom were even contemporaneous and based in different regions. This issue can also be addressed further by extending the data-set to encompass other bio-bibliographical sources, whether Imāmī, non-Imāmī-Shīʿī or non-Shīʿī. For instance, we have compiled a list of *ghālī ḥadīth* transmitters based on *Rijāl Ibn al-Ghaḍāʾirī* and again run our designed experiments for RQ1 and RQ2, incorporating this additional data into our datasets. The results show that the inclusion of *Rijāl Ibn al-Ghaḍāʾirī* in our data-set does not significantly alter the outcomes for both RQ1 and RQ2 (see respectively Figure 6 and 7). For RQ1, there is no difference between the results obtained when including in or excluding *Rijāl Ibn al-Ghaḍāʾirī* from the data-set. As for RQ2, the difference between including and excluding this bio-bibliographical source is minimal, indicating that only one chapter differs in the top ten *ghālī*-community-transmission ranking between the two databases.

2) Kulaynī's ordering and classification of topics: To address this issue, we have initially utilised the measure of textual neighbourhood in *al-Kāfī* to identify *ghālī*-intensive sequences. We have implemented varying sequence lengths (from W=20 to W=120) to assess whether a particular sequence length significantly impacted our results or not. It became evident that beyond a sequence length W=40, the concept of sequence loses its semantic consistency, and even in some cases, crosses the boundaries of chapters. Moreover, this

threat can further be mitigated in future study by following two ways: 1) Including other Imāmī and non-Imāmī (Sunnī, Ismāʿīlī, Zaydī, and Nusayrī) collections of *ḥadīths*, and 2) automating the identification of similar textual clusters, even non-adjacent, by using machine learning and text similarity tools.

3) Small sample lengths in short sections: There are some certain examples of the sections in *al-Kāfī*, in which the results might be biased due to the small length of these sections. In these cases, a *ghālī*-labelled *ḥadīth* transmitter, to whom a book on a particular subject or a series of adjacent *ḥadīths* related to a particular topic has been attributed, may significantly distort the overall interpretation. Collecting contents on similar topics from other collections of *ḥadīths* as well as linking these contents among available *ḥadīth* sources by using machine learning techniques can significantly mitigate this issue.

4) Kulaynī's selection of *ḥadīths*: It is obvious that Kulaynī applied a filtering process in his selection of *ḥadīths*, making it challenging to uncover actual theological tenets related to *ghuluww*. The *ghālī* contents which might have been removed by Kulaynī have become inaccessible, and of course, the parts admitted by him are amplified in our study. However, since it seems unlikely that a *ḥadīth* compiler like Kulaynī consistently eliminated all such contents across a large body of *ḥadīths*, it is still possible to identify some theological tenets, if any, which might belong to the *ghālī* tendency. Moreover, applying the proposed data analysis to other Imāmī and non-Imāmī collections of *ḥadīths* would not only mitigate the filters imposed by *ḥadīth* compilers like Kulaynī but expose such filters used by these individuals. In this regard, statistical and machine learning techniques can be employed to detect differences in distributions and anomalies.

5) Prolific *ghālī* transmitters: Prolific *ghulāt*, like Sahl b. Zīyād, overshadow other *ghālī* transmitters with fewer *ḥadīths*, potentially filtering out certain theological tenets held by sub-communities of *ghulāt*. In this paper, we have recognised such patterns through manual reading of two sample chapters. However, this does not scale without considerable effort unless we apply an automated technique. By clustering communities of *ghālī* transmitters and further refining the clusters of ideas associated with them, one can provide a scalable solution to this issue.
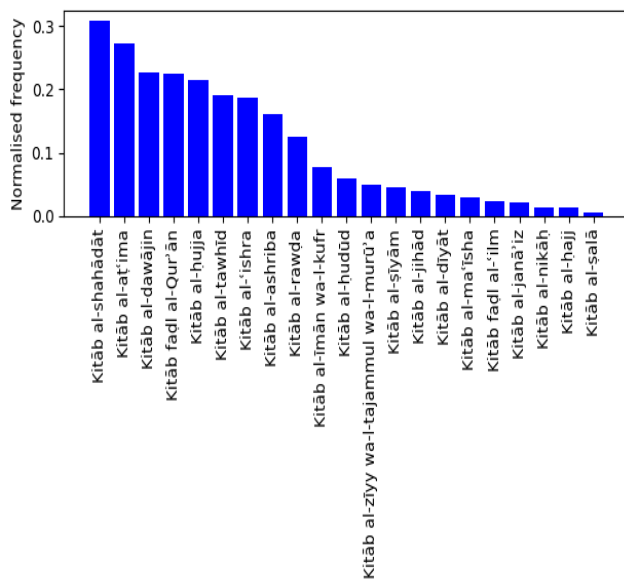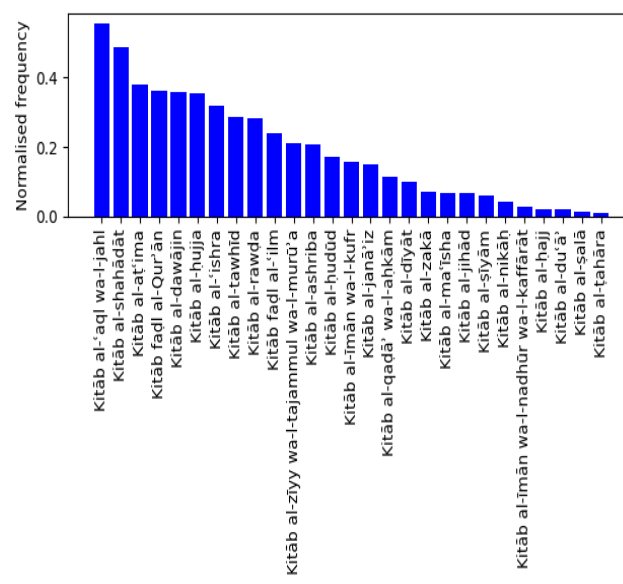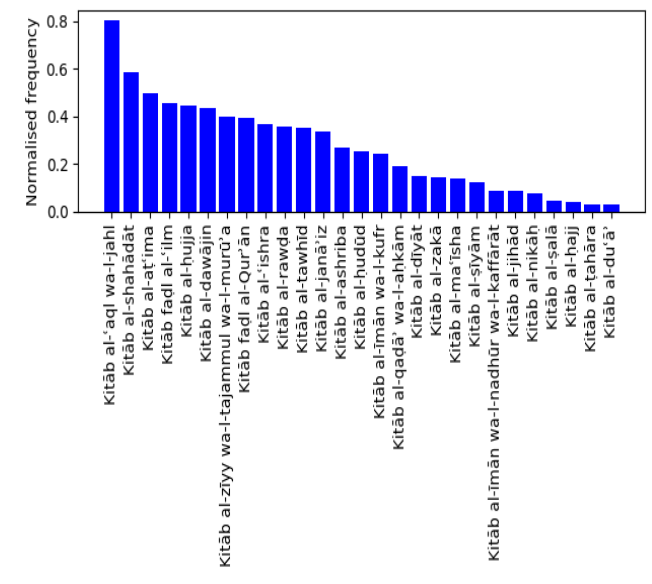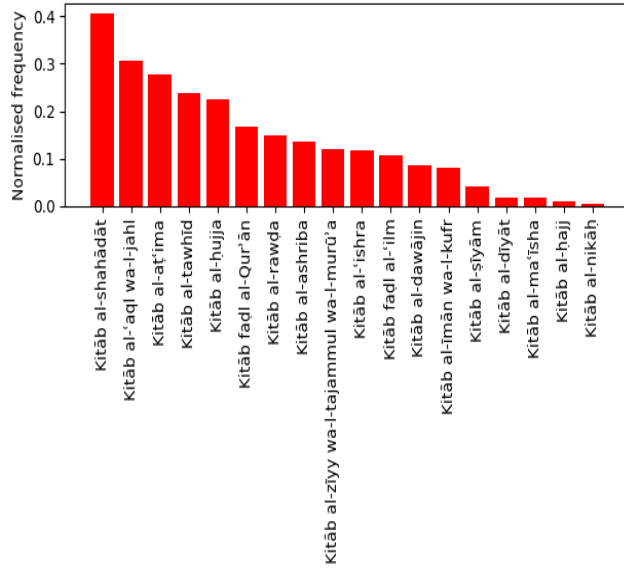
Figure 6. RQ1 (Including *Rijāl Ibn al-Ghaḍāʾirī*)

Top 1000 ḥadīths (W=20)

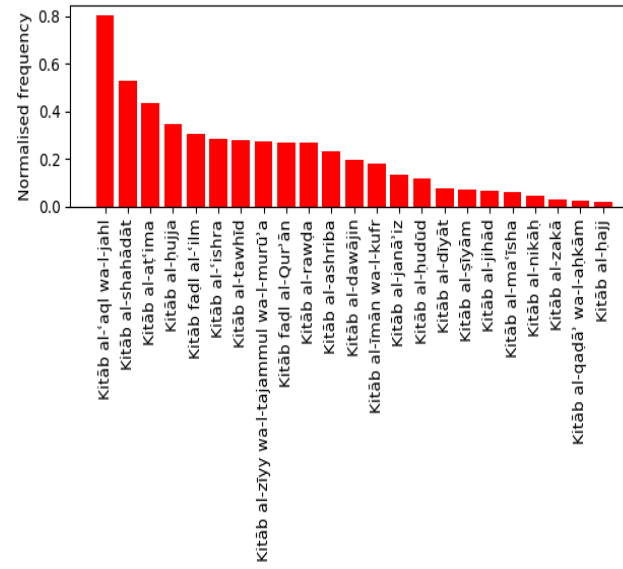Top 2000 ḥadīths (W=20)
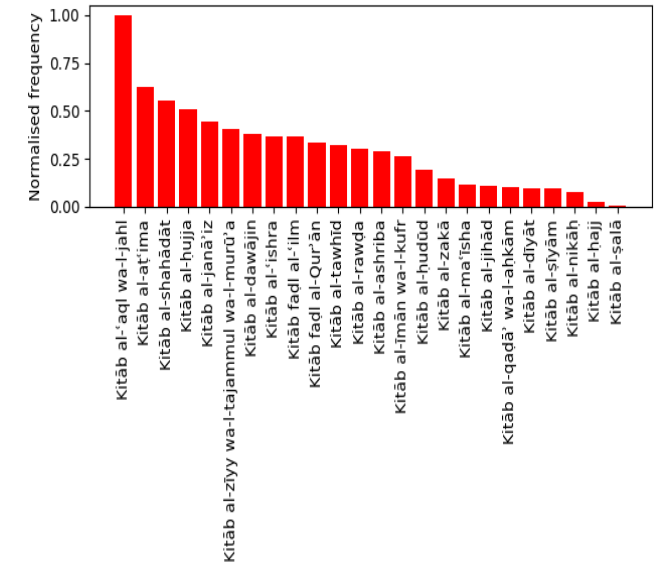
Top 3000 ḥadīths (W=20)

Top 1000 ḥadīths (W=40)

Top 2000 ḥadīths (W=40)

Top 3000 ḥadīths (W=40)
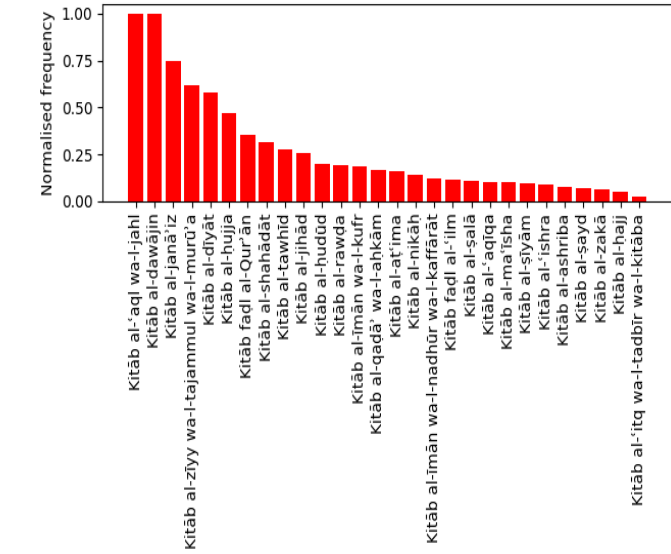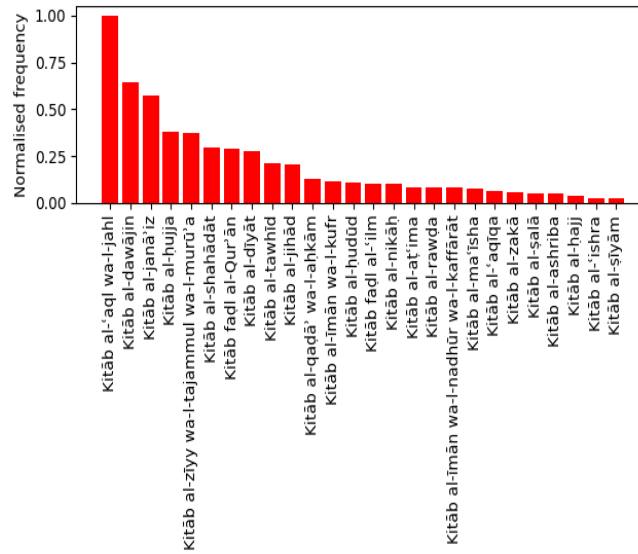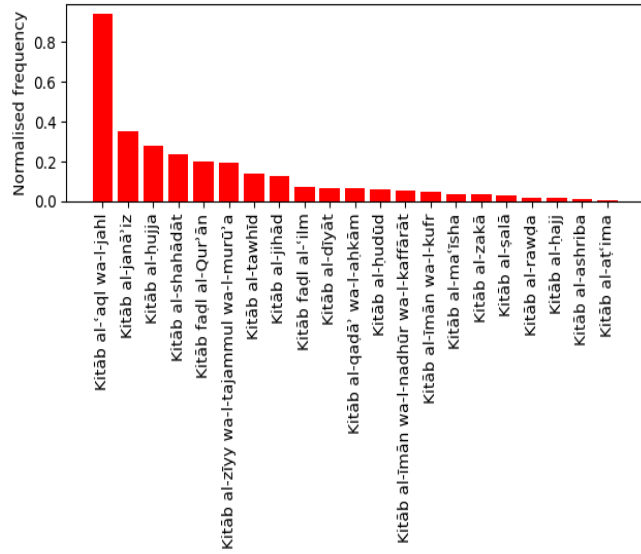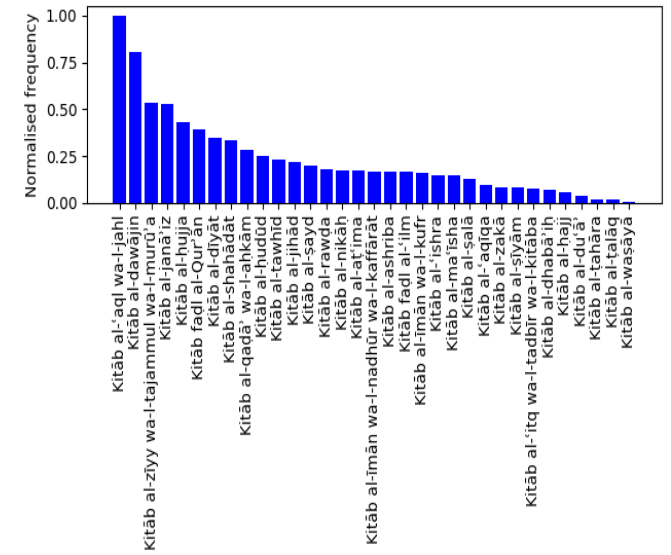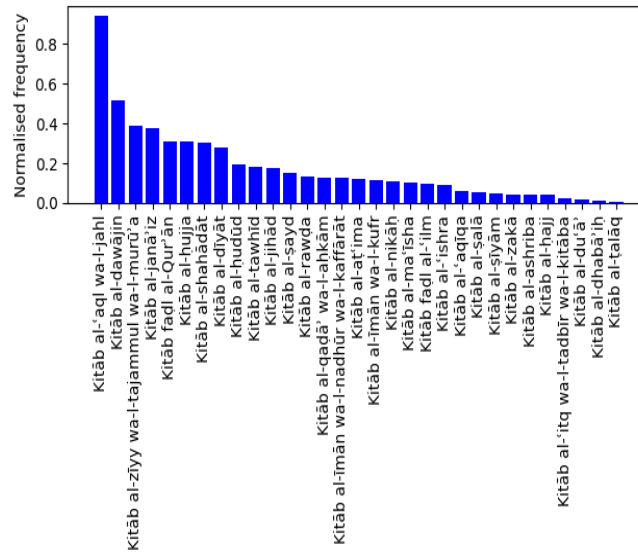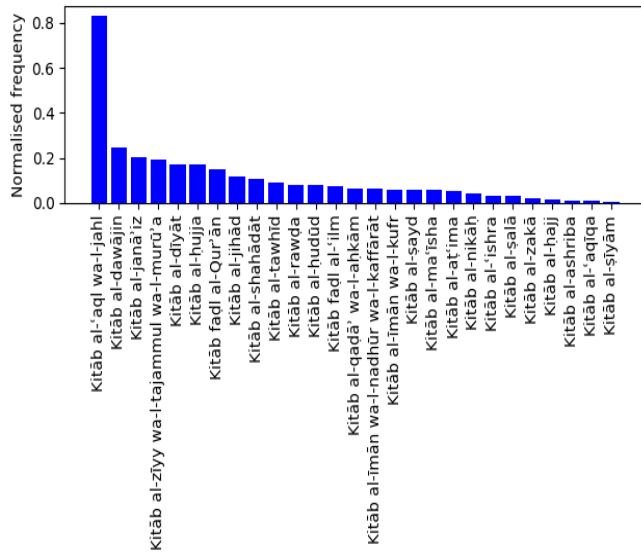
Figure 7. RQ2 (including *Rijāl Ibn al-Ghaḍāʾirī*)

Conclusion

This paper has developed and conducted a data-analytic experiment on the *isnāds* and *matns* of *ḥadīths* included in Kulaynī's *al-Kāfī* to identify its highest *ghālī*-intensive and *ghālī*-community-transmission contents. 12 different metrics have been defined and applied to rank the chapters of *al-Kāfī*. Our analysis of the highest *ghālī*-intensive and *ghālī*-community-transmission chapters has revealed that the overall picture of what is called the concept of *ghuluww*, considering the-fifth/eleventh-century bio-bibliographical literature, is diffuse. The findings of this study do not correlate with what is often regarded as the theological tenets of ghuluww in academic scholarship. While *Kitāb al-shahādāt*, which focuses on legal issues, is ranked as the highest *ghālī*-intensive chapter in *al-Kāfī*, *Kitāb al-ḥujja*, one of the most important extant Imāmī theological literature, is not a very high *ghālī*-intensive chapter (ranked tenth among the top ten *ghālī*-intensive chapters).

Although the developed data-analytic approach and the results of applying it to *al-Kāfī*'s *ḥadīths* provide some insights and ideas that can inform modern academic scholarship, it appears yet challenging to define a consistent theological doctrine for *ghuluww* based solely on an Imāmī *ḥadīth* collection like *al-Kāfī*. As the in-depth manual examination of two *ghālī*-intensive chapters, *Kitāb al-shahādāt* and *Kitāb al-ḥujja*, demonstrates, still no meaningful correlation between the contents of *ḥadīth* transmitted by *ghālī*-labelled transmitters and their being accused as *ghulāt* can be proposed. This issue might be mitigated by apply the same data analytic approach to and further detailed analysis of other available Imāmī *ḥadīth* collections. Another important mitigation would be to identify sub-communities among the *ghulāt*. This not only sheds light on the evolution and potential variations in the concept of *ghuluww* over the first five Islamic centuries but also helps tackle the previously discussed issue of prolific *ghālī* transmitters overshadowing other *ghulāt* with fewer *ḥadīths*.

It is possible to even have a more consistent picture on the history and the development of the concept of *ghuluww* by employing broader *ḥadīth* corpora, whether Imāmī, non-Imāmī-Shīʿī, or non-Shīʿī, expanding the data-set to include other bio-bibliographical sources, automating the identification of textual clusters through different *ḥadīth*, and some other ways to mitigate the possible threats to

generalising any theory on *ghuluww*, which are touched upon in this paper. It seems that to make the process of such comprehensive study on the history of *ghuluww*, using machine learning can be considered as a useful tool for identifying *ghālī* communities and determining the ideas associated with them. This also enables one to even recognise those transmitters who belong to the *ghālī* tendency but might not been labelled by the extant bio-bibliographical dictionaries.

Appendix: List of *Ghālī*-Labelled *Ḥadīth* Transmitters in *al-Kāfī*

1. Furāt b. al-Aḥnaf[27]
2. Muḥammad b. ʿĪsā b. ʿUbayd[28]
3. Muḥammad b. Sulaymān al-Daylamī[29]
4. Muḥammad b. Bashīr[30]
5. Ṭāhir b. Ḥātam al-Qazwīnī[31]
6. Muḥammad b. Jumhūr al-ʿAmmī[32]
7. Muḥammad b. al-Fuḍayl al-Ṣayrafī[33]
8. Muḥammad b. Ṣadaqa al-ʾAnbarī[34]
9. Al-Ḥasan b. ʿAlī b. Abī ʿUthmān[35]
10. Aḥmad b. Hilal al-ʿAbartāʾī[36]
11. Al-Ḥusayn b. ʿUbayd Allāh b. Sahl al-Qummī[37]
12. Muḥammad b. ʿAbd Allāh b. Mihrān al-Karkhī[38]
13. Muḥammad b. al-Ḥasan b. Shammūn[39]

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[27] See Ṭūsī, *Rijāl al-Ṭūsī*, 119.

[28] See idem., *Fihrist al-Ṭūsī*, 402.

[29] See idem., 343.

[30] See idem., *Rijāl al-Ṭūsī*, 344.

[31] See idem., *Fihrist al-Ṭūsī*, 255.

[32] See idem., 413.

[33] See idem., *Rijāl al-Ṭūsī*, 365.

[34] See idem., 366.

[35] See idem., 375.

[36] See idem., *Fihrist al-Ṭūsī*, 83.

[37] See idem., *Rijāl al-Ṭūsī*, 386; Najāshī, *Rijāl al-Najāshī*, 42.

[38] See idem., 350; Ṭūsī, *Rijāl al-Ṭūsī*, 391.

[39] See Ṭūsī, *Rijāl al-Ṭūsī*, 402; idem., *Ikhtīyār*, 613.

14. Naṣr b. al-Ṣabbāḥ al-Balkhī[40]

15. Muḥammad b. Sinān al-Zāhirī[41]

16. ʿAbd Allāh b. al-Qāsim b. al-Ḥārith[42]

17. Khālid b. Najīḥ al-Jawwān[43]

18. Yūnus b. Ẓabyān[44]

19. Munakhkhal b. Jamīl al-Asadī[45]

20. Sulaymān b. ʿAbd Allāh al-Daylamī[46]

21. Sufyān b. Muṣʿab al-ʿAbdī[47]

22. al-Ḥasan b. ʿAlī b. Abī Ḥamza al-Baṭāʾinī[48]

23. Dāwūd b. Kathīr al-Riqqī[49]

24. Abū Al-Ḥasan al-Sawwāq[50]

25. Muḥammad b. ʿAlī Abū Sumayna[51]

26. Dāwūd b. al-Qāsim al-Jaʿfarī[52]

27. Ismāʿīl b. Mihrān b. Muḥammad b. Abī Naṣr[53]

28. Ibrāhīm b. Yazīd[54]

29. Al-Ḥusayn b. Saʿīd al-Nawfilī[55]

30. Aḥmad b. Muḥammad al-Sayyārī[56]

31. Khaybarī b. ʿAlī b. al-Ṭaḥḥān[57]

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[40] See idem., *Rijāl al-Ṭūsī*, 449.

[41] See idem., *Fihrist al-Ṭūsī*, 406.

[42] See Najāshī, *Rijāl al-Najāshī*, 226.

[43] See Ṭūsī, *Ikhtiyār*, 2:619.

[44] See idem., 2:657.

[45] See idem., 2:664.

[46] See idem., 2:673.

[47] See idem., 2:704.

[48] See idem., 2;742.

[49] See Najāshī, *Rijāl al-Najāshī*, 156.

[50] See Ṭūsī, *Ikhtiyār*, 2:806.

[51] See Ṭūsī, *Ikhtiyār*, 2;823.

[52] See idem., 2:841.

[53] See idem., 2:854.

[54] See Najāshī, *Rijāl*, 24.

[55] See Najāshī, *Rijāl al-Najāshī*, 38.

[56] See idem., 80.

[57] See idem., 154.

32. Sahl b. Zīyād al-Ādamī[58]

33. ʿAbd Allāh b. ʿABd al-Raḥmān al-Aṣam[59]

34. ʿAbd Allāh b. Khaddāsh[60]

35. ʿAlī b. al-ʿAbbās al-Jarāḏīnī[61]

36. ʿAlī b. Ḥassān al-Hāshimī[62]

37. Muḥammad b. ʾŪrama al-Qummī[63]

38. Muḥammad b. Mūsā b. ʿĪsā al-Hamdānī

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[58] See idem., 185.

[59] See idem., 217.

[60] See idem., 228.

[61] See idem., 225.

[62] See idem., 251.

[63] See idem., 329; Ṭūsī, *Fihrist al-Ṭūsī*, 407.

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