

Female Coming of Age: A Content Analysis Approach of Digital Humanities in Joyce Carol Oates's *Mudwoman* (2012)

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Abstract—This study explores the theoretical basis and ways to realize the integration of contemporary digital technology and literary research, and looks forward to the analysis of the application of digital literary research by using Joyce Carol Oates's novel *Mudwoman* (2012). The novel expresses great concern for the social crisis and the spiritual dilemma of human beings in contemporary America through the observation of the daily life of individuals in America. The previous research results of *Mudwoman* tend to make subjective judgments by traditional literary research methods, lacking relevant data support and innovative research perspectives and methods. In this study, we analyze the text of *Mudwoman* with a combination of content analysis based on digital humanities perspective. The results of this study reveal that M.R.'s coming of age is a path of identity search. In general, M.R. experiences childhood abandonment and kinship alienation, and the construction of her self-identity is fractured. It leads to the distress of interpersonal interactions in adulthood, aggravating her identity crisis. But with the help of kinship, she faces her past and predicament, returns to her spiritual home, reconciles with her past, and thus achieves the reconstruction of her identity.

Index Terms—content analysis, female coming of age, digital humanities, *Mudwoman*, identity crisis

I. INTRODUCTION

Digital Humanities, usually defined as Humanities Computing or Computing in the Humanities, is a new multidisciplinary research subject that extensively integrates contemporary computer and network technology into established humanities research and education, and its emergence and development are due to the advancement of digital technology and its popular application in the field of science (Wang et al., 2020). Digital humanity is a typical interdisciplinary discipline in the construction of the new liberal arts in the digital era, which began with the creation of Index Thomisticus in collaboration with IBM (Passarotti, 2019). Digital humanities, as the name suggests, is the application of computer technology in humanities research (Caldeira, 2020). Digital literary studies, on the other hand, is a subfield of digital humanities research, also known as Digital Humanities for Literary Studies (DHLS). The adoption of computational methods for literary studies is not a new topic. However, given the quick advancement of modern information technology, the scope and ways of integrating digital technology and literary studies are undergoing great changes, highlighted by the fact that literary studies are constantly developing new ideas and tools with contemporary information technology represented by big data and artificial intelligence (O'Sullivan, 2021). Despite this, many theoretical and methodological problems in digital literary research still need to be solved.

Content analysis generalized after World War II, the systematization of the method is marked by Klaus's use of content analysis to study the trends and dynamics of social change in the United States, written as a household name in the book *Trend* (Krippendorff, 2018, pp. 17-18). Initially, the content analysis method was applied to journalism, where some people calculated the number of newspaper stories of a particular type to examine the focus of coverage and the state of social opinion. As the method became more mature, it was widely used in digital humanities research as a quantitative analysis method based on qualitative research. The content analysis method converts verbal rather than quantitative texts into quantitative information and then describes the results of the analysis in statistical terms. Since this method can analyze the "quantity" of the content and derive features

that reflect the essence of the text to a certain extent and are easy to count, it can overcome some defects of purely qualitative research, namely subjectivity and inaccuracy, to achieve a more precise and profound understanding of the “quality” of the text. The textual content of a text can be understood in a more precise and profound way (Krippendorff, 2018, p. 181).

Mudwoman is a novel written by Joyce Carol Oates. It is permeated with the strong female coming of age. In this novel, Oates draws on the third-person narrative perspective to show the dilemma of knowing and reinventing oneself that M.R., a mud girl, faces in her growing-up process, with the help of the third-person narrative perspective and the memory of her childhood, which also suggests the main problems faced by the elite group of American women in their coming-of-age process. Many scholarly articles are studying Oates' novel, mainly from the perspectives of gender, identity construction, and narrative. Using a digital humanities approach, this study explores the coming-of-age process of women in Oates' novel, starting with the characters highlighted in the novel. Before analyzing the novel, the author adopted a digital humanities approach to research, building a corpus of the original mud woman based on the actual corpus of Oates' novel.

II. RESEARCH METHODOLOGY

Many software programs support content analysis of large amounts of text (Silver & Lewins, 2014). In this study, based on a digital humanities perspective, content analysis is used in conjunction with KH Coder analysis software (Higuchi, 2016a), KH Coder has become increasingly popular among researchers in recent years. As of November 2016, more than 1,000 academic documents have been published using this software for research (Higuchi, 2016b), but mainly Japanese language documents are predominant. However, due to the convenience of this research tool, which is friendly to humanities and social science researchers who do not know how to program, the number of academic papers in English using it as a research tool has increased in recent years (Aihara et al., 2022; Aoki et al., 2020; Baha & Shishido, 2022; Baltranaite & Povilanskas, 2019; Blasco Gil et al., 2020; Ekaterina, 2018; Nattuthurai & Aryal, 2018; Yingming & Katsunori, 2019). However, there are still only a few studies in the analysis of literary works (Pinich, 2018; Sera, 2020, 2022). In this study, KH Coder was chosen for data mining and statistical analysis of the text of *Mudwoman*.

By converting the novel text of *Mudwoman* into plain text (txt.) format and importing it into KH Coder, high-frequency words and hierarchical clustering were derived. At the same time, the whole text document was tagged for data mining, and the text coding function was used to grasp the development trend of the main line of the text in the form of a network common line graph, and the relevant data in the graph was combined with the corresponding text content to make an objective and detailed empirical analysis of the female coming of age of *Mudwoman*, and the text content of *Mudwoman* was reinterpreted in the form of a data graph to grasp the main line of text development. We also reinterpret the text content of *Mudwoman* in the form of data diagrams to grasp the main lines of text development. Combined with the established word frequency table, bubble chart and network co-occurrence analysis chart, we integrated relevant data to further analyze the text content and high-frequency vocabulary of *Mudwoman*, and provided data support for the text content analysis, to enrich and develop the empirical research results of the previous study.

III. RESULTS AND DISCUSSION

A. Text Word Frequency Statistics

The most popular and fundamental method for determining text subjects is word frequency statistics. It is predicated on the idea that constantly occurring words provide more important clues to reveal textual themes than infrequently occurring words (Ryan & Bernard, 2003). By calculating the probability of two or more words occurring together, co-occurrence network research focuses on the semantic networks of high-frequency terms, and thus co-occurrence networks reveal information that is not evident through word frequency analysis alone (Doerfel & Barnett, 1999; Sauntson & Morrish, 2010). A co-occurrence network identifies a subgroup of related words of the same nature that express a concept, or a cluster. This is an exploratory approach to data analysis, where the process of organizing the data is completely unaware of which clusters will emerge without any preconceptions (Anzai & Matsuzawa, 2013).

First of all, under the condition of detailed differentiation of vocabulary categories for the text content of the classification of high-frequency vocabulary screening statistics, automatically exported text high-frequency vocabulary Excel table, select the top 15 ranking of the five categories of lexical nature for statistics.

TABLE 1

PRP	Freq	Noun	Freq2	ProperNoun	Freq3	Adj	Freq4	Verb	Freq5
she	5556	child	339	UNIVERSITY	330	little	194	know	501
he	2397	woman	323	NEUKIRCHEN	292	more	122	see	390
you	1336	man	314	KONRAD	277	good	119	think	354
I	1132	face	228	AGATHA	193	young	115	say	340
they	849	eye	220	Stirk	183	many	108	come	275
we	326	life	204	Andre	164	old	105	make	243
herself	157	girl	170	CARTHAGE	144	small	100	seem	241
my	146	house	170	Suttis	144	several	92	speak	241
himself	70	president	166	Mrs	134	few	81	take	184
itself	23	something	146	Mr	126	first	81	feel	177
themselves	14	voice	138	Jewell	124	own	78	want	173
yourself	14	hand	134	Schneider	113	new	70	go	164
myself	9	sort	124	Skedd	102	high	69	leave	157
ourselves	6	name	123	God	92	long	65	call	146
theirs	2	word	122	Mudgirl	86	most	58	tell	141

As the results in Table 1 show, the highest frequency of PRP is “she”, which is far ahead of the second-ranked word, indicating the importance of female characters in the story. The noun has the highest frequency of “child”, and “woman”, and the Proper Noun is “university”, indicating that the novel is a third-person narrative about women coming of age on campus. The most frequent words in Verb are “know” and “think”. These words show the mental state of mud women, which will be explored in detail in the KWIC feature analysis later.

According to the hierarchical clustering of selected high-frequency words in nouns, pronouns and tags, taking ward’s method applying cosine distance and a select number of clusters 5, the result (Figure 1) can be seen that the coming-of-age process of mud woman can be divided into five types of zones.

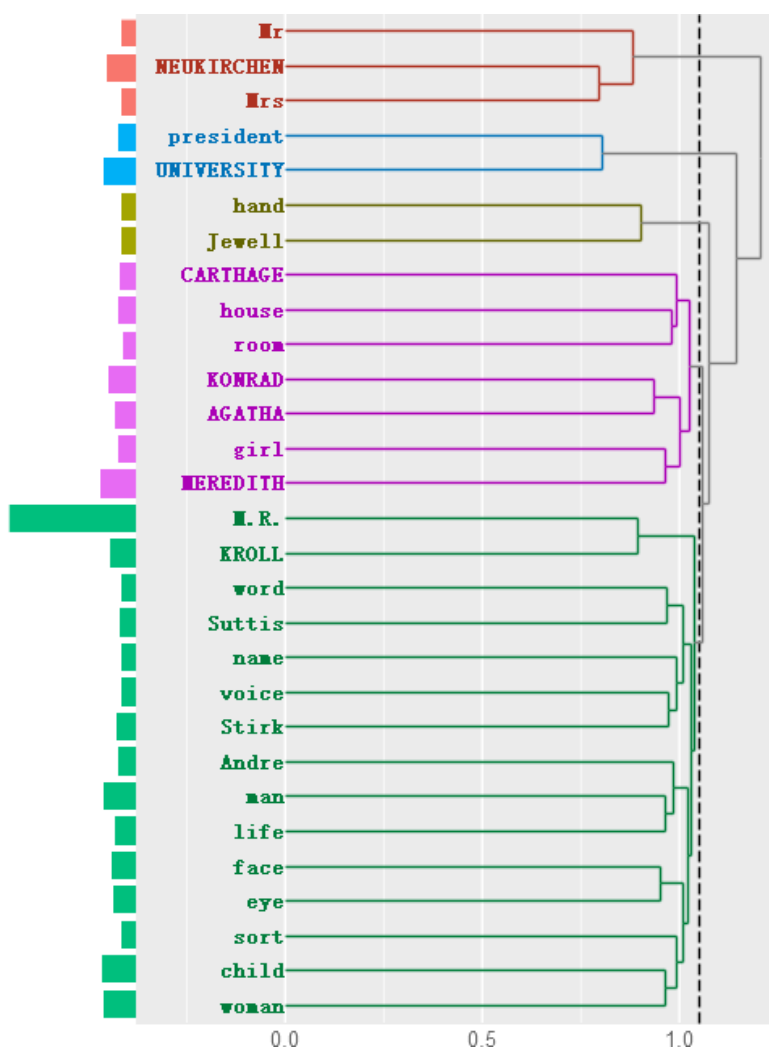


Figure 1

In the first category, “Mr and Mrs Neukirchen” are a couple who adopted a mud woman. They have lost their infant daughter and therefore care for her. But the love and favor that the mud woman receives belong to another girl - the dead infant daughter. In fact, in this family, she loses her true identity and becomes a substitute for the other girl.

The second category, “president” and “university”, shows that Oates places the protagonist in a high-level academic circle, and M.R., after graduating with a PhD with an outstanding professional thesis, successfully joined the faculty of a well-known Ivy League university and became the first female president.

In the third category, “Jewell” and “Hand” embody the experience of the mud woman who was abandoned by her biological mother after birth and by her first adoptive family. At this time the mud girl Jewell’s biological mother, due to mental abnormalities, sacrificed her daughter as a sacrifice in a mud puddle by the river in upstate New York and her life was in danger. After being rescued by scavengers, Jewell lived in the first temporary foster home for a while. Although his life was safe, he was often bullied by the children in the neighborhood.

The fourth category of “Carthage, house, room, Konrad, Agatha, girl, Meredith” can be seen, the mud woman was adopted by the second couple Konrad and Agatha changed her name to Meredith and has since lived in these spaces in Carthage, house, room and gradually achieved success.

In the fifth category, the words “M.R., Kroll, word, Suttis, name, voice, stirk, Andre, man, life, face, eye, sort, child, woman” embody the state of life of the mud woman in the workplace with her colleague Kroll and her lover Andre. It emphasizes the image of M.R. as a strong woman who is stumbling, muddy and mentally exhausted in her career and love.

Plot analysis is the basis of an in-depth understanding of the novel, with the help of the theme word map plot to observe the sequence and distribution density of the theme words in the whole text, you can visually and specifically analyze the thematic development of the text or the relationship between the plot advancement and the words, to recognize and grasp the development of the plot of the novel in an all-round way.

TABLE 2

DocID	Names	Freq	Norm Freq	Dispersion	Plot
1	Skedd	117	764.986	0.316	
2	Agatha	193	1261.9	0.635	
3	Konrad	277	1811.12	0.579	
4	Marit	30	196.15	0.521	
5	Schneider	102	666.911	0.322	
6	Andre	164	1072.288	0.632	

It can also be seen from Table 2 that the different designations of heroine M.R. at different stages of her life are distributed in different people, to further clarify the word frequency in the plot distribution of the whole novel, we should notice the five appellations: “M.R., Meredith, Mudwoman, Mudgirl, Jewell”. The statistics of the plot development of different epithets during the coming of age of *Mudwoman* are shown in Table 3

TABLE 3

DocID	Names	Freq	Norm Freq	Dispersion	Plot
1	M.R.	293	1915.734	0.914	
2	Meredith	355	2321.111	0.594	
3	Mudwoman	48	313.84	0.663	
4	Mudgirl	88	575.374	0.626	
5	Jewell	124	810.754	0.422	

It can be seen from Table 2, the abbreviated name “M.R.” is found throughout almost the entire work and is distributed in the widest density. Oates deliberately uses abbreviations to refer to herself; on the one hand, she uses them to avoid discrimination due to her feminine name. On the other hand, she intends to emphasize her self-identity, hoping to distinguish herself from another person with the same name. The most frequent use of “Meredith” is concentrated in the middle and later parts of the novel and is the name given by her second adoptive

parents. This name was once the name of their deceased daughter. “Mudgirl” and “Mudwoman” are also distributed throughout the novel, but are used less frequently. “Mudgirl” focuses on her early childhood traumatic memories and adolescent experiences. “Jewell” is mainly used in the middle part of the text, and is the name she is called in her first temporary foster home after being rescued by her mother after being thrown into a mud puddle. The metaphorical function of mud woman with different naming further reinforces her sense of loss of self-identity. The constant change of the heroine’s name shows that she grows up with a constantly shifting identity, which brings her a heavy identity crisis.

B. Analysis of Textual Content Coding

To further explore the data related to the main line of the text, we coded the text content again. To combine with the data mining of the corresponding text content, we set the relevant content of the coding document in advance. The five characters that appear frequently in the main line of text as representative factors were coded in advance in their form, and saved in a separate txt format. Then we imported the coding document and created bubble diagrams and heat maps of the corresponding factors (see Figure 3).

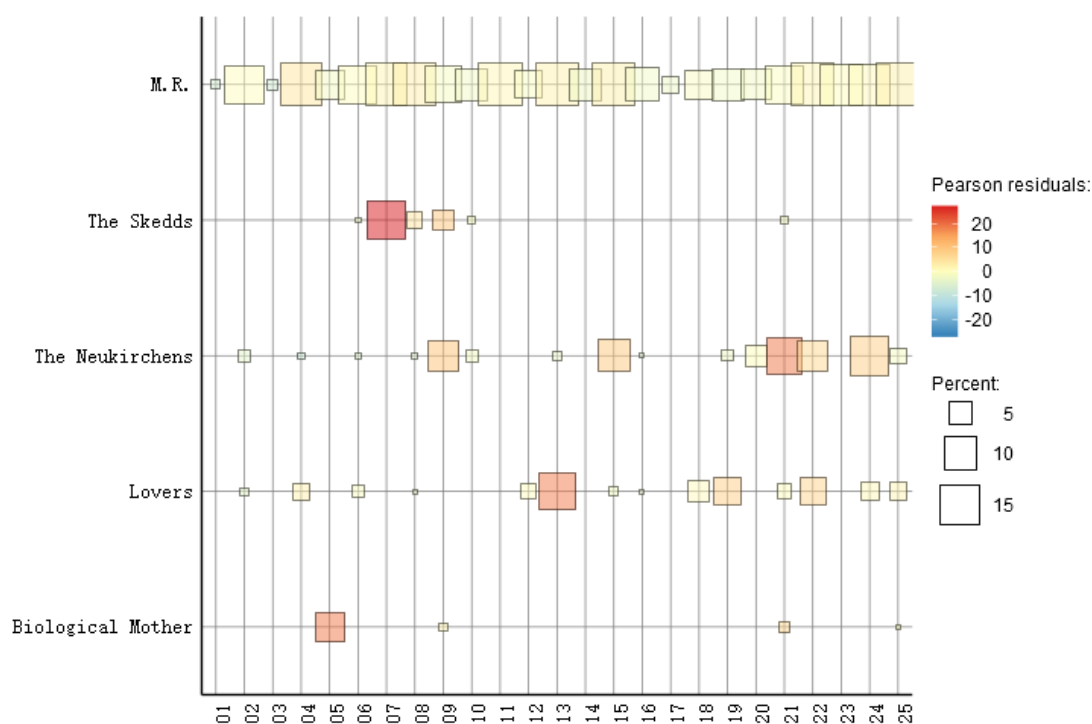


Figure 2

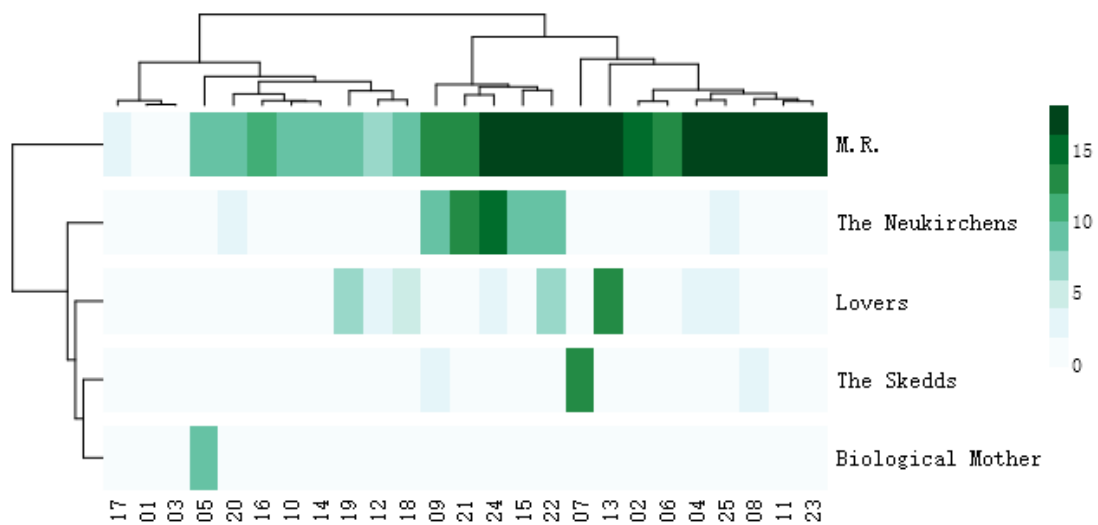


Figure 3

As can be seen in Figure 2-3, there is little description of M.R.’s biological mother, which appears primarily in Chapter 5. In the context of the religious backlash of the 1960s, her biological mother treats her daughter as the

Moriah sacrificed to God by Isaac in Genesis and prepares to drown her as a sacrifice in the mud flats along the Black Snake River in upstate New York. The crowing of the King of Crows scared off Marit. After scavenger fished M. R. out of the mud flats, she was adopted by the Skedds family. The figure shows that the mud girl lives in the Skedds family for a short time, appearing mainly in chapters 7 and 9. Later Agatha and Konrad Neukirchen adopted her, and they transferred their love for their daughter, who died young, to her, caring for her and educating her. M.R. was hard-working, outstanding in her studies, and loved sports. She yearns for the full love of her adoptive parents, and seeing them secretly grieving for Molly, she cannot help but feel jealous and “lost, isolated, and alone” (Oates, 2012, p. 299). At the age of eighteen, she did not listen to her adoptive mother and insisted on moving away from home, enrolling and eventually studying at Cornell University, where M.R. became the first female president of New Jersey’s prestigious Ivy League university and a Harvard PhD, by far the most professionally accomplished woman Oates has ever portrayed. This experience is depicted more frequently and intensively. She left the sphere of influence of her lover, the astronomer André Litovik, after her PhD, and, with her outstanding writings, made her way to this university, where she worked her way from assistant professor to department chair and president in just eight years. Oates does not describe much about M.R.’s love affairs. It is clear that Andre, fifteen years older than M.R., had more influence on her than on guiding and encouraging her intellectual pursuits. This includes the moral support he provides her from the perspective of an older intellectual. However, the affair illustrates M.R.’s lack of awareness of herself, leading to emotional deviation and affecting her relationship with her colleague Oliver Crowell.

With the lover by her side, she gradually became emotionally stable and was discharged home to spend three months with her adoptive father, Konrad. With Konrad’s help and understanding, she faced her past openly, visited her biological mother in a mental hospital, and visited her adoptive family’s home and the Black Snake River mud flats. She feels the happiness of being loved, gradually calms down, reorganizes her life, and cares about school affairs. M.R. regained her confidence. Her new life will be very different from the one she had before. Because now she is stronger than before. Now she is ready.

C. Contextual Analysis of the Characters

In traditional novels, characters are the core of the imaging system of the work. The KWIC (keywords in context) function in the corpus search software helps us analyze the characters in the work. The main characters in the text usually appear at the top of the keywords list. If you enter a relevant high-frequency word and use the search software to retrieve the full text, the words and their co-occurring contexts are listed in alphabetical order. The related words and phrases searched constitute a micro-context, or co-text, of the search term. This micro-context can provide a reliable basis for collocation analysis of search terms and thematic analysis of the text. We can list the contexts in which the high-frequency words of verbs appear as if we were producing a picture of the activities of the relevant characters. By summarizing and analyzing the collected verbs and phrases, we can describe the appearance, activity, character, and mental activity of the characters. Using this method, we can collect all the descriptions of the analyzed characters, which is important for studying the character traits and the artistic techniques used by the writers to shape the characters’ personalities.

According to the high-frequency words in Table 1, we selected the first two nouns child and university, and the first two verbs “know” and “think”, to conduct contextual analysis. Taking these four words as the center, we selected three-to-four-word nests on the left and came up with Table 4.

TABLE 4

Left Context	Hit	Right Context
It was a good thing, to grow. Perceiving, even	as a child,	that you must grow, or you will
M.R. imagined him as a young adolescent, or	as a child	intimidated by bigger boys, made to feel
take a child—Suttis is simple and honest	as a child	himself and would never do harm, not
girl speculating about time travel—as if,	as a child,	she could have known what time travel
was a sound of sobbing, choking. Helpless	as a child	she hid her face. “Oh hey, ma’
and Agatha’s tangled garden. Her father rapt	as a child	riskily peering up into the night sky
It was a good thing, to grow. Perceiving, even	as a child,	that you must grow, or you will

Left Context	Hit	Right Context
time while M.R. was president of the	University	and Andre Litovik was—still—married. Look,
needed to be alone. As president of the	University	M. R. Neukirchen was scheduled for luncheons,
in her place. When the president of the	University	was absent, other administrative officers would
upon, spoken of, that the president of the	University	had hurried to the ER before dawn
first year. The first president of the	University	who is a woman? How grateful she
of feeling, this new president of the	University	was known to clasp hands in hers,
Alexander Stirk, yet the president of the	University	had prevailed. More or less. The University
Left Context	Hit	Right Context
had anything to do with . . . I don't know	know	what Alexander told you or hinted at
sorry. I've behaved unconscionably. I don't know	know	why—I think—I think that—that
he was very upset. Now, I don't know	know	what to think. Or rather, I know
of uneasily. And I was—I don't know	know	why—so embarrassed.” Konrad laughed.
My mother is—alive?” “Well, I don't know	know	that. I can't say if she'
been, once. To be frank I don't know	know	too much about her history. There's
Left Context	Hit	Right Context
Your face.” M.R. laughed, annoyed. “I don't think	think	so. No.” Now came the sly fox-smile. “You'
“Kraeck. That your name?” “ ‘Kraeck.’ I don't think	think	so.” “You look like her.” M.R. didn't
R. knew to smile. Reasonably she said: “I don't think	think	so, really. I live hundreds of miles away.”
he had said, that might be irrevocable. “I don't think	think	so, Oliver. After—this—I'm not hungry. I
it from the first, Meredith.” “I—I don't think	think	so, Mr. Schneider. . . .” “Yes. Of course—you
named ‘Kraeck.’ “ ‘ ‘Krae-chek’? I don't think	think	I know anyone named ‘Krae-chek.’ “ ‘ ‘Maybe
car? Maybe can I ride with you?” “I don't think	think	so. . . .” “Where you headed so anxious-like,

The two most frequent verbs show that they are prefixed with many negative forms: cluster size 3 on the left of “child” is “as a child” and cluster size 4 on the left of “university” is “president of the university”. The two most frequent phrases represent the difficult coming-of-age process of the heroine, who is an abandoned child in a mud puddle and grows up to be the president of the university. The cluster size 3 on the left of know and think are “I don't know” and “I don't think” respectively. These two phrases are directly quoted, and a lot of dialogue in the first person is used, reflecting the uncertainty, entanglement and ambivalence of the heroine in the novel.

Oates deepens the anxiety of women's coming of age in the plot design. Through the noun prefix and the verb negative prefix, she shows that M.R.'s early childhood encounters and teenage experiences influence the focus of her adult intellectual pursuits, her emotional life, and her choice of life path. This situation had a significant impact on M.R.'s mental health to a large extent. The absence and incompleteness of intimacy caused lasting trauma to M.R.'s mental distress led to the “mud girl” being subjected to the experience of being a foster child, bullied, and uncared for at a young age. Her emotional deficit was compensated for by the loving care of her foster parents. Since she left home at the age of 18, she has been pursuing knowledge as her goal. But in terms of personal spirituality, her estrangement from her adoptive parents cut off the possibility of continued affection, and an unhealthy extramarital affair did not guarantee her a positive sense of spiritual satisfaction. However, as a result of her emotionally frustrating experience, she did not understand her adoptive parents' grief over the death of their daughter and was unable to appreciate her own emotional needs. As a result, she ignores and hurts the feelings of her loving adoptive parents and her math teacher. The suppressed childhood and adolescent experiences, combined with the pressures and conflicts of reality, lead to M.R.'s psychological imbalance. The absence and incompleteness contrasted with M.R.'s gains in professional achievement and social status. With Konrad's help and enlightenment, she confronts her past openly, visiting her biological mother in a mental institution, her adoptive family's home and the Black Snake River mud flats. She feels the happiness of being loved, and gradually calms down and regains her confidence: “Tomorrow her new life would begin. Her new life will be very different from the life she had before. Because now she is stronger than before. Now she's ready and willing” (Oates, 2012, p. 412).

IV. CONCLUSION

Based on the digital humanities perspective, this study used content analysis to conduct textual data mining and visual analysis of female coming of age and related character content in Joyce Carol Oates's literary work

Mudwoman text. The feasibility and necessity of the research topic were determined through the textual digital frequency statistics of the top 15 high-frequency words of each lexical category. After coding the text with the KH Coder cross-analysis function, the whole document was cross-analyzed concerning the five main characters in the development of the textual theme line. In the form of bubble diagrams and heat intensity, the text content and related details were comprehensively controlled from a macro perspective. Using the KWIC function, the nouns and verbs with high ranking were selected and analyzed in conjunction with the specific text content of each section.

We can also present it more visually using the network co-occurrence chart. According to the five categories of word frequency in Table 1, the top 200 high-frequency words were selected, and the minimum spanning tree only was calculated by using cosine distance to generate the following Figure 4. The keyword is more significant the larger the circle. Clusters of the same circle color are created by connecting the circles representing the keywords with lines. The quantity of circles within a cluster denotes the significance of the information it contains, the more circles there are, the more important the information or concept expressed by these connected keywords (Anzai & Matsuzawa, 2013).

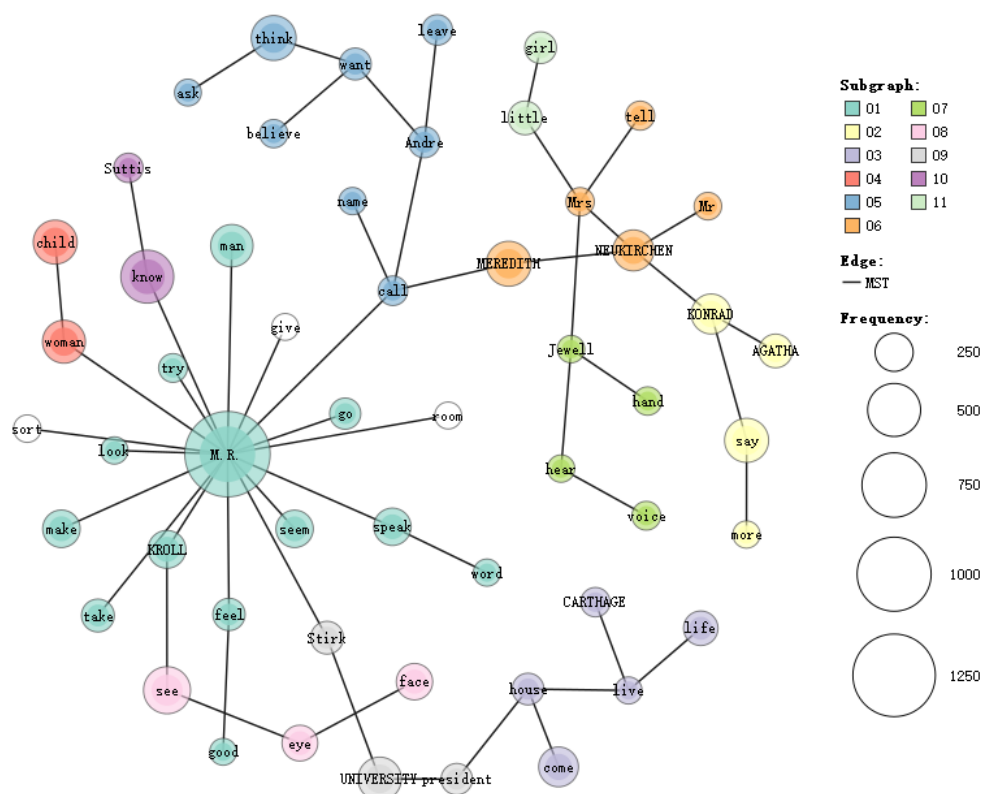


Figure 4

Through the above network co-occurrence diagram, we can find that Oates explores the elements necessary for a woman's coming-of-age process. Co-occurrence relationships such as affection, love, friendship, intellectual pursuit, professional recognition and social status. This highlights the different stages of a woman's needs and desires. It explores the intertwined relationships between personal destiny and human nature, social environment and interpersonal relationships. It highlights the theme of the novel, that is, personal struggle, achievement and happiness are closely related to personal experience and self-perception under the influence of many external factors.

Combined with the detailed textual content, it can be seen that the shift in space from the dirty black mud pond to the bright university office represents not only a leap in the social hierarchy but also an opportunity to explore identity from desolation to vibrancy. The protagonist experiences childhood abandonment and kinship alienation, and the construction of self-identity is fractured, leading to the distress of interpersonal interaction in adulthood, thus aggravating the identity crisis. In the end, with the help of his family, the heroine confronts her past and difficulties, returns to her spiritual home, and reconciles with her past, thus realizing the reconstruction of her identity. Like many of Oates' psychological realist works, in *Mudwoman*, Oates expresses his great concern for the crisis of contemporary American society and the plight of the human spirit through his observation of the daily lives of individuals in America. The observation of human nature and the heart is a constant entry point for the writer. Oates shows readers the difficult path of self-identity search and the possibility of spiritual restoration as

individuals cope with the crisis. It could be concluded that the heroine M.R.'s rough experience of coming of age as a woman is the road of identity search. According to the reference data provided by the graph, it can be seen that the five different names of mud woman are closely arranged in the core area, and the central media value is extremely high.

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