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Python-Based Algorithmic implementation of Soft Set Haussdorff Topological Spaces with an Example for Medical Diagnosis and its application in Chemical Classification

L. Jeeva[1], Dr. G. Selvi[1*], I. Rajasekaran[2], sreelakshmi Lingineni[3]

[1,1*,2] Department of Mathematics, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Sciences, Chennai- 602105, Tamil Nadu, India.

Email ID: jeeval9074.sse@saveetha.com

[*1]Emaill ID: mslalima11@gmail.com

[2]Department of Mathematics, Tirunelveli Dakshina Mara Nadar Sangam College, T. Kallikulam-627113, Tirunelveli District, Tamil Nadu, India.

Email ID: sekarmelakkal@gmail.com

[3]Department of Mathematics, Veltech Rangarajan Dr Saguntala R&D Institute Of Science and Technology, Chennai, Tamil Nadu, India.

Email ID: lingineni@gmail.com

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ABSTRACT

Soft set theory has demonstrated significant utility in decision-making processes involving ambiguous or imprecise data. This research presents a novel framework called SSHT-Space (Soft Set Haussdorff Topological Space), structured using a bipartite graph model. Our studies explore twodistinct SSHT-Spaces, denoted as ($\acute{\alpha}_S$, τ_{SS}, H_S) and (β_S, τ_{SS1}, H_{S1}), each designed to capture unique topological properties within the soft set context. We provide Python-based algorithmic solutions to investigate these areas, focusing on their ability to capture complicated interactions. A key application area is chemical reactions, where SSHT-Spaces represent bonding patterns, particularly among inert gases. Furthermore, we demonstrate the relevance of this approach in medical applications, particularly for understanding and predicting aspects of heart disease by employing bipartite graph structures, We improve the interpretability and practical utility of soft topological constructs in real-world scenarios, thereby opening new avenues for ongoing research and practical application.

Keywords: *soft set, soft topology, soft set Haussdorff space, Bonding inert gases, bipartite graph, chemical reaction, heart disease.*

1. INTRODUCTION

Soft set theory gained significant traction following the works of P.K. Maji, R. Biswas, and R. Roy [1][2], who not only formalized the theory but also showcased its application in decision-making problems. Their contributions opened avenues for extending soft sets into topological contexts. M. Shabir and M. Naz [3] were among the first to introduce and systematically investigate soft topological spaces, offering definitions and foundational properties analogous to classical topologies. They demonstrated that soft sets could be used to define open and closed soft sets, continuity, and compactness, thereby establishing a strong theoretical backbone for the field.

The structure of soft topological spaces revolves around the notion of a soft set defined over a universe and a parameter set, where each parameter is associated with a subset of the universe. By integrating these ideas with topological concepts, researchers have modeled various real-life scenarios characterized by parameter-dependent uncertainty. For example, F. Feng et al. [4] explored algebraic aspects of soft sets, such as soft semirings, which have implications for the algebraic structure of soft topological spaces. Furthermore, Çağman and Enginoğlu [13] extended the theory by redefining soft topologies to refine earlier results and establish stronger foundations. Their approach emphasized the flexibility of soft topologies in defining continuity and neighborhood systems, which are crucial in analyzing soft continuous mappings. Additional work by B.P. Verol and H. Aygin [9] introduced soft Hausdorff spaces, further enriching the classification of soft topologies and highlighting separability conditions in soft frameworks. The work of G. Selvi and I. Rajasekaran [11] on nano topological spaces parallels this development, showing the interplay between soft and nano topologies in analyzing complex systems.

Beyond mathematics, these soft topological frameworks have potential applications in fields such as chemistry and decision sciences. Insights into periodic and non-periodic classifications from chemistry [6][8] and foundational concepts from general topology [7] contribute to the multidimensional utility of soft topologies.

In summary, the evolution of soft topological spaces demonstrates a powerful fusion of soft set theory and classical topological structures. With continued exploration and refinement, this field holds promise for addressing nuanced problems in mathematics, science, and engineering where uncertainty is a central concern.

Beyond these mathematical advancements, research extends to the classification and comparison of chemical elements, particularly inert gases. Inert gases, known for their non-reactive nature, include Helium (He), Neon (Ne), Argon (Ar), Krypton (Kr), Xenon (Xe), and Radon (Rn). Their non-reactivity arises from their completely filled valence electron shells, which make them stable and resistant to forming chemical bonds. When determining whether two inert gases share a relationship, comparisons are made by analyzing their filled valence shells. This fundamental understanding of inert gases plays a crucial role in chemistry, physics, and various industrial applications.

Graph theory can also be applied to medical science, particularly in diagnosing heart disease. In SSHT-Space, symptoms of heart disease can be represented as a bipartite graph, where one set of vertices represents patients and the other represents symptoms. By analyzing the structure of this graph, we can classify individuals based on their symptoms and determine the urgency of medical intervention.

We denote SSTS-Soft Set Topological Space (τ_{SS}). Consider the notation $ά_S$ be universal Soft Set.We introduced ($ά_S$, $\tau_{SS,}$ H_S) SSHTS-Soft Set Haussdorff Topological Space.

2. PRELIMINARIES

Definition 2.1 [1] LetI and E are first universe and parameters respectively.Let f (I) be power set ofIand J be a non empty setof $\wp$. A pair of ($\bar{G}$, $\wp$) is called soft set overI. Where $\bar{G}$ is mapping given by$\bar{G}$: $\wp \rightarrow f$ (I).

Definition 2.2

Letτ_{SS}be the collection of soft sets over $ά_S$, it said to be a soft topology on $ά_{S.}$.if

1. Φ_S,$ά_S$belong to $\tau_{SS.}$
2. The union of any number of soft sets in $\tau_{SS.}$
3. The intersection of any two soft sets in$\tau_{SS.}$

Definition 2.3

The soft set ($\bar{G}$, $\wp$) is denoted by $(\bar{G}, \wp)^C$and is defined by ($\bar{G}$, $\wp$)$\subseteq$($\bar{G}^C$,X/À) where

$\bar{G}^C$:$ά_S$ /À$\rightarrow f$ (I) is mapping given by $\bar{G}^C(x)$ =I/$\bar{G}$(x) for all (x$\in$À).

Definition 2.4

Let ($\bar{G}$,E) be a soft set over X and Y be a non- zero subset of X.Then the soft set ($\bar{G}$,E) over Y denoted by ($\bar{G}$, E).$[F(x)]^Y$= Y$\cap\bar{G}$(x), for all x$\in$E.

Definition 2.5

A soft topological space is a generalization of a classical topological space, defined over a soft set. It consists of a universe set $ά_S$, a set of parameters E_s, and a collection of soft sets over $ά_S$ that satisfies the conditions analogous to open sets in traditional topology. Specifically, the family of soft sets must be closed under the operations of arbitrary soft unions and finite soft intersections.

Definition 2.6 [9]

Let ($ά_S$, τ_{SS}) and (β_S, τ_{SS1})be two SSTS. A soft mapping $\bar{G}_S$:($ά_S$,τ_{SS}) $\rightarrow$(β_S,τ_{SS1}) is called a homeomorphism. If$\bar{G}_S$is bijective, then the soft sets are continuous and open.

Definition 2.7 [5]

A graph $\bar{G}_S$ consists of two finite set $\tilde{V}$ ($\bar{G}_S$) and Ȅ ($\bar{G}_S$) are called set of vertices and edges respectively.

Definition 2.8 [5]

A graph whose edges are null or empty is called a null graph. It is denoted by $\Phi(\bar{G}_S)$.

Definition 2.9 [6]

A topological space ($ά_S$, τ_{SS}) is said to be H_S (Haussdorff space). If for any two distinct points x, y$\in ά_S$ there exists disjoint open sets $\acute{U}_S, \tilde{V}_S \in \tau_{SS}$ such that $x \in \acute{U}_S$ and $y \in \tilde{V}_S$.

Definition 2.10 [10]

A chemical reaction occurs when one substance is transformed into another material substance including both compounds and Chemical elements. They are made up of the reactants atoms and rearranged during Chemical reactions, resulting in distinct compounds as products.

3. **SSHT-Spaces**

This section examines two soft set Hausdorff topological spaces, presenting appropriate examples to highlight their characteristics, applications and consequence in topology.

Definition3.1

A soft set topological space ($\acute{\alpha}_S$, τ_{SS}, H_S) is said to be SSHT-Spaces, iff for every two distinct soft points $s_1 \neq s_2 \in \acute{\alpha}_S$, there exists two disjoint soft open sets $\acute{\alpha}_{S1}$ and $\acute{\alpha}_{S2}$ such that $s_1 \in \acute{\alpha}_{S1}$ and $s_2 \in \acute{\alpha}_{S2}$.

Example 3.2

A soft set $\acute{\alpha}_S$ on the universe $\acute{\alpha}$ is defined by the set of order pairs and E_S is the parameter.

Consider $\acute{\alpha} = \{\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5\}$ and $E_S = \{e_1, e_2, e_3\}$

$\acute{\alpha}_S = \{(e_1,\{\alpha_1,\alpha_2\}), (e_2,\{\alpha_2,\alpha_3\}), (e_3,\{\alpha_4,\alpha_5\})\}$,if

$\acute{\alpha}_{S1} = \{(e_1,\{\alpha_1,\alpha_2\}), (e_2,\{\alpha_3\}), , (e_3,\{\alpha_5\})\}$ and

$\acute{\alpha}_{S2} = \{(e_2, \{\alpha_2\}), , (e_3,\{\alpha_4\})\}$

$Hs = \acute{\alpha}_{S1} \cap \acute{\alpha}_{S2} = \acute{\alpha}_{\Phi}$.

Then $\tau_{SS} = \{\acute{\alpha}_{\Phi}, \acute{\alpha}_S, \acute{\alpha}_{S1}, \acute{\alpha}_{S2}\}$ is a SSTS. Hence ($\acute{\alpha}_S$, τ_{SS}, H_S) is a SSHT –Spaces.

Python coding:

```
Define the Universe and Parameters
alpha = {'α1', 'α2', 'α3', 'α4', 'α5'}
ES = {'e1', 'e2', 'e3'}
# Define Soft Sets as dictionaries
alphaS = { 'e1': {'α1', 'α2'}, 'e2': {'α2', 'α3'}, 'e3': {'α4', 'α5'} }
alphaS1 = { 'e1': {'α1', 'α2'}, 'e2': {'α3'}, 'e3': {'α5'} }
alphaS2 = {  'e2': {'α2'},  'e3': {'α4'} }
Define the intersection function for soft sets
def soft_set_intersection(A, B):
    result = {}
    for key in A:
        if key in B:
            result[key] = A[key].intersection(B[key])
    return result
Compute Hs = αS1 ∩ αS2
Hs = soft_set_intersection(alphaS1, alphaS2)
# Define τSS (Soft Set Topological Space)
tauSS = [dict(), alphaS, alphaS1, alphaS2]  # dict() is α∅
# Define SSHT Space as a tuple
SSHT_space = (alphaS, tauSS, Hs)

# Output the results
```

```
print("Intersection Hs (α∅):", Hs)
print("\nSSHT Space (αS, τSS, Hs):")
print("αS =", alphaS)
print("τSS =", tauSS)
print("Hs  =", Hs)
```

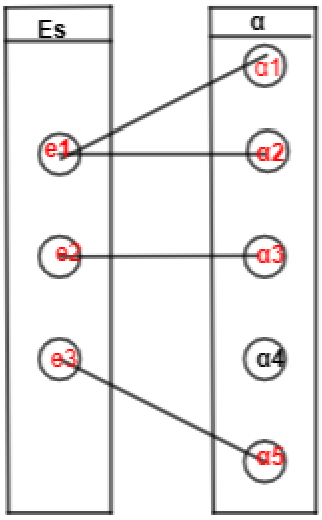

Figure1. $\acute{\alpha}_{S1}$

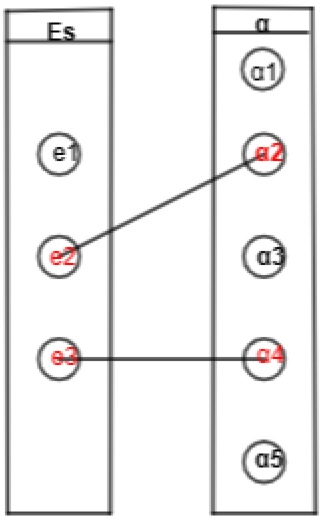

Figure2. $\acute{\alpha}_{S2}$

Example 3.3

We can choose players in the class = $\{P_1, P_2, P_3\}$ consider the indoor and outdoor game

$E = \{e_1 = \text{Chess}, e_2 = \text{Cricket}\}$

$\acute{\alpha}_S = \{(e_1,\{P_1, P_2\}), (e_2,\{P_2, P_3\})\}$ if

$\acute{\alpha}_{S1} = \{(e_1,\{P_1,P_2\}), (e_2,\{P_3\})\}$ and

$\acute{\alpha}_{S2} = \{(e_2,\{P_2\})\}$

$H_S = \acute{\alpha}_{S1} \cap \acute{\alpha}_{S2} = \acute{\alpha}_{\Phi}$.

Then $\tau_{SS} = \{\acute{\alpha}_{\Phi},\acute{\alpha}_S, \acute{\alpha}_{S1}, \acute{\alpha}_{S2}\}$ is a SSTS. Hence $(\acute{\alpha}_S, \tau_{SS},H_S)$ is a SSHT –Spaces.

Python coding:

```
# Define the set of players and games
players = {'P1', 'P2', 'P3'}
games = {'e1', 'e2'}  # e1 = Chess, e2 = Cricket
# Define soft sets as dictionaries mapping parameters to sets of players
alphaS = { 'e1': {'P1', 'P2'},    # Chess  'e2': {'P2', 'P3'}     # Cricket }
alphaS1 = { 'e1': {'P1', 'P2'},  'e2': {'P3'}}
alphaS2 = {  'e2': {'P2'}}
# Define intersection function for soft sets
def soft_set_intersection(A, B):
    result = {}
    for key in A:
     if key in B:
      result [key] = A[key].intersection(B[key])
    return result
```

```
# Compute HS = αS1 ∩ αS2
HS = soft_set_intersection(alphaS1, alphaS2)
# Output
print("Intersection HS (α∅):", HS)
print("\nSoft Set αS:")
print(alphaS)
print("\nSoft Set αS1:")
print(alphaS1)
print("\nSoft Set αS2:")
print(alphaS2)
```

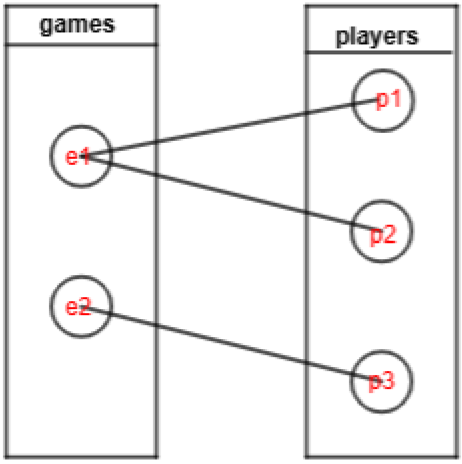

Figure3. $\acute{\alpha}_{S1}$

Figure4. $\acute{\alpha}_{S1}$

Theorem 3.4

If $\bar{G}$: $(\alpha_S) \to (\beta_S)$ be twoSoft Set topological spaces($\acute{\alpha}_S,\tau_{SS}$) and ($\beta_S,\tau_{SS1}$) are bijective where ($\acute{\alpha}_S,\tau_{SS}$) is SSHT-Spaces. Then ($\beta_S$, τ_{SS1}) is also aSHT-Spaces.

Proof:

Let h_{S1}, $k_{S1} \in \beta_S$ be two distinct points with $h_{S1} \neq k_{S1}$ then there exit disjoint open sets β_{S1}, $\beta_{S2} \in \tau_{SS1}$. Since $\bar{G}$: $(\alpha_S) \to (\beta_S)$is bijective, there exist soft points h_S, $k_S \in \acute{\alpha}_S$ such that $\bar{G}$ (h_S) $=h_{S1}$and $\bar{G}$ (k_S) $=k_{S1}$, $h_S \neq k_S$. Because ($\acute{\alpha}_S,\tau_{SS}$) is a SSHT- Spaces. then there exist a soft open sets $\acute{\alpha}_{S1}$, $\acute{\alpha}_{S2} \in \tau_{SS}$, such that

$\acute{\alpha}_{S1} \cap \acute{\alpha}_{S2} = \Phi_S$ where $h_S \in \acute{\alpha}_{S1}$, $k_S \in \acute{\alpha}_{S2}$.

So $\beta_{S1} \cap \beta_{S2} = \bar{G}$ $(\acute{\alpha}_{S1}) \cap \bar{G}$ $(\acute{\alpha}_{S2}) = \bar{G}$ $(\acute{\alpha}_{S1} \cap \acute{\alpha}_{S2}) = \Phi_S$

Also $h_{S1} = \bar{G}$ (h_S) $\in \bar{G}$ $(\acute{\alpha}_{S1}) = \beta_{S1}$, $h_{S2} = \bar{G}$ (k_S) $\in \bar{G}$ $(\acute{\alpha}_{S2}) = \beta_{S2}$

Hence (β_S,τ_{SS1}) is SSHT-Spaces.

Theorem 3.5

If ($\acute{\alpha}_S,\tau_{SS}$, H_S) is a SSHT- Spaces and β_S is a subset of $\acute{\alpha}_S$ then (β_S,τ_{SS1}, H_{S1}) is also a SSHT-Spaces.

Proof*:*

Let h_{S1}, $k_{S1} \in \beta_S$ such that $h_{S1} \neq k_{S1}$.Since β_S is a sub-set of $\acute{\alpha}_S$, we have h_{S1},$k_{S1} \in \acute{\alpha}_S$. Now given that ($\acute{\alpha}_S$, τ_{SS}, H_S) is a SSHT-Spaces, there exist $h_{S1} \in \acute{\alpha}_{S1}$, $k_{S1} \in \acute{\alpha}_{S2}$ and $\acute{\alpha}_{S1} \cap \acute{\alpha}_{S2} = \Phi_S$. Since h_{S1}, $k_{S1} \in \beta_S$ and $\acute{\alpha}_{S1}$, $\acute{\alpha}_{S2}$ are open set in τ_{SS}, the intersections $\acute{\alpha}_{S1} \cap \beta_S$ and $\acute{\alpha}_{S2} \cap \beta_S$ are open in the subspace topology in τ_{SS1}. Therefore (β_S, τ_{SS1},H_{S1}) is also a SSHT- Spaces.

Theorem 3.6

If ($\acute{\alpha}_S,\tau_{SS}$, H_S) is a SSHT-Spaces and first countable iff every sequence $\{\beta_e^{u_n}\}$ of soft point in ($\acute{\alpha}_S,\tau_{SS}$, H_S) converges to at most one point.

Proof:

The theorem is demonstrated through the following Example.

Example:

Let [0, 1] be the real number and the parameter E = {e} and τ_{SS} = {ά$_E$: ά$_E$(e)⊆ [0, 1], ά$_E$(e) is countable} ÙΦ_S

Then ([0, 1],τ_{SS}) is a SSTS which is not first-countable. Now consider a sequence $\beta_e^{u_n}: n\in$ N , where each soft points defined as $\beta_e^{u_n} = \{\frac{1}{n}\}$. let us also define a soft point $\beta_e^{u} = \{0\}$. Assumme that the sequence $\beta_e^{u_n}$ of converges to β_e^{u} in ([0, 1],τ_{SS}). Since the topology τ_{SS} only includes countable sets,and there is no countable neighbourhood base at 0, this assumption leads to a contradiction. Hence the sequence $\beta_e^{u_n}$ does not convergence to β_e^{u}, or to any other soft point.

Theorem 3.7

If ($\beta_{e_n}^{u_n}$, τ_{SS}, H_S) and ($\beta_{f_n}^{v_n}$, τ_{SS1}, H_{S1}) be two SSHT-spaces, then ($\beta_{e_n}^{u_n} \times \beta_{f_n}^{v_n}$, $\tau_{SS} \times \tau_{SS1}$) is an SSHT-Spaces.

Proof:

Let ($\beta_{e_n}^{u_n}$, τ_{SS}, H_S) and ($\beta_{f_n}^{v_n}$,τ_{SS1}, H_{S1}) be two SSHT-spaces.consider $\beta_{(e_1,f_1)}^{(u_1,v_1)}$, $\beta_{(e_2,f_2)}^{(u_2,v_2)} \in(\beta_{e_n}^{u_n} \times \beta_{f_n}^{v_n})$. So we have $\beta_{e_1}^{u_1}\neq\beta_{e_1}^{u_2}$ or $\beta_{f_1}^{v_1} \neq \beta_{f_2}^{v_2}$. Since ($\beta_{e_n}^{u_n}$, τ_{SS}, H_S) is an SSHT-Space. by definition of two distinct points, there exit open sets E_{S1}, $E_{S2} \in \tau_{SS}$ such that $E_{S1} \cap E_{S2}$= Φ_S, $\beta_{e_1}^{u_1} \in E_{S1}$, $\beta_{e_2}^{u_2} \in E_{S2}$. Hence$\beta_{(e_1,f_1)}^{(u_1,v_1)} \in E_{S1} \times F_S$, $\beta_{(e_2,f_2)}^{(u_2,v_2)} \in E_{S2} \times F_S$and ($E_{S1}\times F_S$) ∩ ($E_{S1}\times F_S$) = Φ_S , where $F_S \in \tau_{SS1}$.conversely ($\beta_{e_n}^{u_n}\times\beta_{f_n}^{v_n}$, $\tau_{SS} \times \tau_{SS1}$) is an SSHT-Spaces. Since $\beta_{e_n}^{u_n}$and$\beta_{f_n}^{v_n}$are homomorphic to a subspace of($\beta_{e_n}^{u_n} \times \beta_{f_n}^{v_n}$) ,and subspaces of SSHT-Spaces are also SSHT-Spaces (by theorem 3.5), it followes that: ($\beta_{e_n}^{u_n}$,τ_{SS}, H_S) and ($\beta_{f_n}^{v_n}$,τ_{SS1}, H_{S1})

3. APPLICATIONS OF SSHT SPACES INDUCED BY BIPARTITE GRAPH.

We introduced the concept of SSHT-Spaces and algorithm for covalent bonding using a bipartite graph.

Covalent Bonding occurs when atoms share electron pairs,resulting in a stable configuration for the resulting molecules. All inert gases are chemically non-reactive because, they have a stable and full electron configuration.

Algorithm: 4.1

Step 1: Construct the ά$_S$is inert gas and not inert gas in Soft Set.

Step 2: We choose are random set in the Soft Set, namelyά$_{S1}$and ά$_{S2}$.

Step 3: Check ά$_{S1}$ intersection ά$_{S2}$ result is the empty set,the soft set is SSHT-Spaces.

Step4: Result is non empty set; Soft Set is not SSHT-Spaces.

Step5: Hence H_S = ά$_{S1}$ ∩ά$_{S2}$ = Φ_S, because inert gas does not react any other gases.

Step 6: Then (ά$_S$, τ_{SS}, H_S) is SSHT-Spaces.

Example:

Let gases ά = {He, Ne,Ar, Nit,Ra, Kry, Hyd} where He = Helium, Ar= Argon, Ra=Radon,Nit=Nitrogen,Kry= Krypton, Ne= Neon,Hyd= Hdrogen under consideration Electrons E_s= {e_1= inert gas,e_2=other gas}

ά$_S$ = {(e_1, {He, Ne, Ar, Ra, Kry}) , (e_2, {Nit,Hyd})} if

ά$_{S1}$ = {(e_1, {He, Ar, Ra}), (e_2, {Hyd})} and

ά$_{S2}$ = {(e_1, {Ne,Kry}), (e_2, {Nit})}

H_S = ά$_{S1}$ ∩ά$_{S2}$ = ά$_\Phi$.

Then τ_{SS} = {ά$_\Phi$, ά$_S$, ά$_{S1}$, ά$_{S2}$} is a SSTS. Hence (ά$_S$, τ_{SS}, H_S) is SSHT

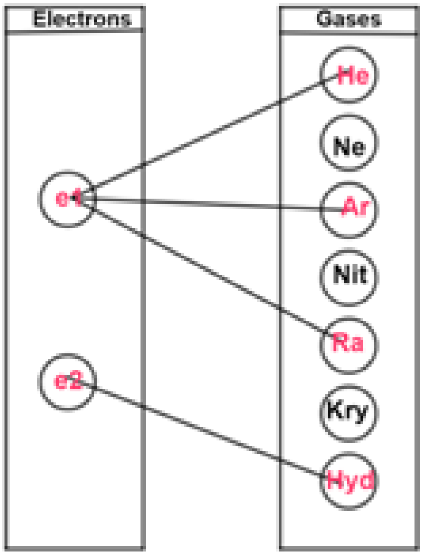

Figure5. ά$_{S1}$

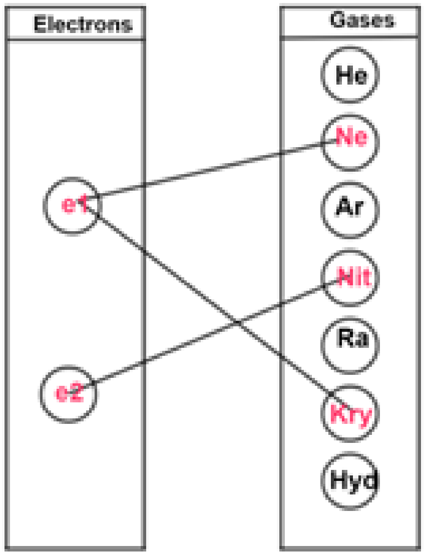

Figure6. ά$_{S2}$

Python coding:

```
 import networkx as nx
import matplotlib.pyplot as plt
# Create a bipartite graph
G = nx.Graph()
# Define node sets
electrons = ["e1", "e2"]
gases = ["He", "Ne", "Ar", "Nit", "Ra", "Kry", "Hyd"]
# Add nodes with bipartite attributes
G.add_nodes_from(electrons, bipartite=0)
G.add_nodes_from(gases, bipartite=1)
# Define edges (relationships between electrons and gases)
edges_left = [("e1", "He"), ("e1", "Ar"), ("e1", "Ra") , ("e2", "Hyd")]
edges_right = [("e1", "Ne"), ("e1", "Kry"), ("e2", "Nit")]
# Create separate graphs for left and right images
fig, axes = plt.subplots(1, 2, figsize=(10, 5))
# Function to draw bipartite graph
def draw_graph(ax, edges, title):
    G_sub = nx.Graph()
    G_sub.add_nodes_from(electrons, bipartite=0)
    G_sub.add_nodes_from(gases, bipartite=1)
    G_sub.add_edges_from(edges)
   pos = {node: (0, i) for i, node in enumerate(electrons)}
    pos.update({node: (1, i) for i, node in enumerate(gases)})
  nx.draw(G_sub, pos, with_labels=True, node_color="lightblue", edge_color="black",
    node_size=2000, ax=ax)
    ax.set_title(title)
```

```
# Draw left graph
draw_graph(axes[0], edges_left, "Left Graph")
# Draw right graph
draw_graph(axes[1], edges_right, "Right Graph")
plt.show ()
```

4. CONCLUSION

In Algorithm 4.1, inert and non-inert gases were studied using Soft Set Hausdorff Topological Spaces (SSHT-spaces). A soft set was developed to differentiate inert gases from reactive gases based on electron properties. We next analyzed two subsets of this soft set and discovered that their intersection was empty, indicating the non-reactivity of inert gases. This demonstrated that the sets constitute a valid SSHT-space, proving the method's ability to represent non-reactive behavior in chemical elements. Bipartite graphs were used to illustrate these linkages. The technique is a powerful tool for making decisions in uncertain contexts, especially in chemistry and classification systems. The findings emphasize the utility of SSHT-spaces for both theoretical and practical applications.

4.1 Characterization of Symptom-Person Relationships Using SSHS-Spaces

Heart disease is becoming increasingly common,which is a serious concern. Symptoms of a heart attack may include pain or discomfort in the Chest pain or discomfort in the Arms, left Shoulder, Elbows jaw and back. In addition, the person may experience difficulty in Breathing or Shortness of breath; nausea or vomiting. The best way to prevent protects ourselves. We are making lifestyle modifications to live a healthier life. Avoiding smoking and alcohol, eating a balanced diet rich in fruits and vegetables while avoiding high-salt and fat foods, and exercising regularly.

Example:

Suppose that there are five sick person in the hospital $ά = \{s_1,s_2,s_3,s_4,s_5\}$ under consideration and that $E_S = \{E_1, E_2, E_3, E_4, E_5\}$ where E_1 = chest pain, E_2 = pain, E_3 = shortness of birth, E_4 = nausea,E_5 = sweating.

Table 1

Sick persons /symptoms	E_1	E_2	E_3	E_4	E_5	Result
S_1	+	-	+	-	-	Positive
S_2	-	+	-	-	+	Negative
S_3	+	-	-	-	+	Positive
S_4	-	-	-	+	-	Negative
S_5	+	+	+	-	-	Positive

Clearly

$ά_S = \{(E_1,\{s_1,s_3 , s_5 \}), (E_2,\{s_2, s_5 \}), (E_3,\{s_1, s_5 \}), (E_4, \{s_4\}), (E_5, \{ s_2,s_3\}) \}$ if

$ά_{S1} = \{(E_1,\{s_1,s_3, s_5 \}), (E_2,\{ s_5 \}), (E_3 ,\{s_1 , s_5\}), (E_5, \{ s_3\}) \}$ and

$ά_{S2} = \{(E_2,\{s_2 \}), (E_4,\{s_4 \}), (E_5, \{s_2 \})\}$

$H_S = ά_{S1} \cap ά_{S2} = ά_{\Phi}$.

Then $\tau_{SS} = \{ά_{\Phi}, ά_S, ά_{S1}, ά_{S2}\}$ is a SSTS. Hence $(ά_S,\tau_{SS})$ is a SSHT –Spaces.

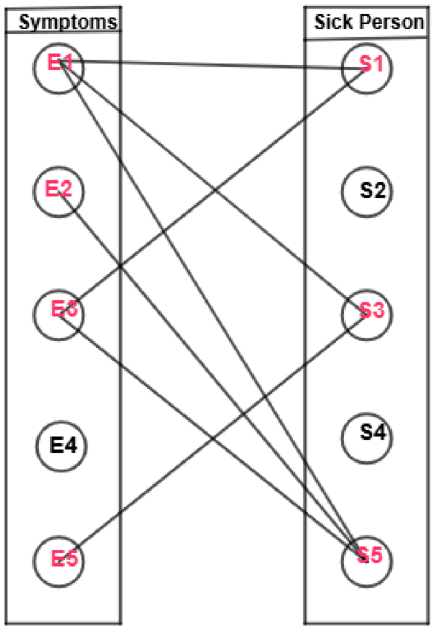

Figure 7. $\acute{\alpha}_{S1}$

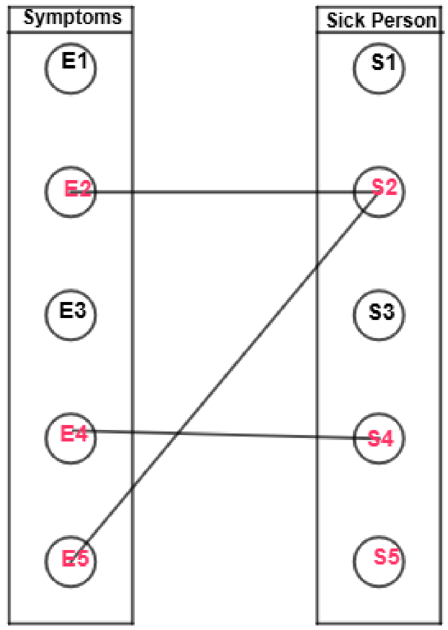

Figure 8. $\acute{\alpha}_{S2}$

Python coding:

```
import networkx as nx
import matplotlib.pyplot as plt
# Define bipartite sets
symptoms = ["E1", "E2", "E3", "E4", "E5"]
sick     = ["S1", "S2", "S3", "S4", "S5"]
# Define edge-lists according to your soft sets:
# S1 = {(e1->{α1,α2}), (e2->{α3}), (e3->{α5})}
edges_S1 = [ ("E1", "S1"), ("E1", "S2"), ("E2", "S3"), ("E3", "S5"), ]
# S2 = {(e2->{α2}), (e3->{α4})}
edges_S2 = [("E2", "S2"), ("E3", "S4"), ]
def draw_softset(edges, title, node_color=("skyblue","lightcoral")):
    """Draw one bipartite soft-set."""
    B = nx.Graph()
    B.add_nodes_from(symptoms,  bipartite=0)
    B.add_nodes_from(sick,      bipartite=1)
    B.add_edges_from(edges)
 # positions: symptoms on left (x=0), sick on right (x=1)
    pos = {}
    for i, v in enumerate(symptoms):
        pos[v] = (0,  -i)
    for i, v in enumerate(sick):
        pos[v] = (1,  -i)
plt.figure(figsize=(4,5))
    # draw nodes
```

```
   nx.draw_networkx_nodes(B, pos, nodelist=symptoms, node_color=node_color[0], node_size=600)
   nx.draw_networkx_nodes(B, pos, nodelist=sick, node_color=node_color[1], node_size=600)
 # draw edges and labels
   nx.draw_networkx_edges(B, pos, width=2)
   nx.draw_networkx_labels(B, pos, font_size=12, font_color="black")
 plt.title(title)
 plt.axis("off")
# Draw Figure 7: άS1
draw_softset(edges_S1, "Figure 7. άS1")
# Draw Figure 8: άS2
draw_softset(edges_S2, "Figure 8. άS2")
```

5. CONCLUSION

We investigated the links between heart disease symptoms and affected individuals using the Soft Set Hausdorff Topological Spaces (SSHS-spaces) framework. The soft sets $ά_{S,}$ $ά_{S1}$, and $ά_{S2}$ were created to represent different levels of symptom-person relationships. We established that the space meets the Hausdorff separation criterion in a soft topological setting by proving that $ά_{S1} \cap ά_{S2} = ά_{Φ}$. The linked bipartite graphs (Figures 7 and 8) gave visual clarity on how symptoms are distributed across individuals, allowing for the quick identification of clusters and disconnected cases. These graphs are more than just topological representations; they are also useful tools for diagnosing and evaluating crucial medical disorders.

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REFERENCES

[1] P.K.maji, R.Biswar, R.Roy soft set theory comput.Math.Appl.45 (2003), pp 555-562.

[2] P.K.maji, R.Biswar, R.Roy An application of soft sets in a decision making problem comput.Math.APL. 44 (2002).pp 1077-1083.

[3] M. Shabir and M. Naz, on soft topological spaces, Comput. Math. Appl. 61 (2011) 1786-1799.

[4] F. Feng, Y. B. jun, x.z.zhao soft semi rings computers and math. With APPL.56 (2008), pp 2621-2628.

[5] Thumbakara R.K. Geogrge, B.soft graph. Gen math Notes 2014; 21(2):75-86.

[6] Cao, c, Vernon, R.E, Schwarz, “understand periodic and Non-periodic “chemistry in Periodic Tables.

[7] Weinstein, E.W. (2021). “Https: \\mathworld.wolfram.com\Topology.html. Accessed: Jun 20, 2021

[8] Frontiers in chemistry, https: \\ www. Frontiers in. org\ articles\10.339\fchem.2020.00815 Accessed: Aug 2021.

[9] B.P.Verol and H.Aygin on soft Haussdorff space, Ann Fuzzy Math Inform 5(1)(2013) 15-24.

[10] Quaittoo, W. (2003),”The Ultimate Chemistry for Senior Secondary school”, William Agyapong Quattoo, Accra, 4th Edition, 538pp.

[11] G. Selvi, I. Rajasekaran, On nano Mr-set and Mr+set in nano topological spaces, Advances in Mathematics: Scientific Journal, 9(11) (2020),9345-9351.

[12] Molodtsov, D. (1999). Soft set theory—first results. *Computers & Mathematics with Applications, 37* (4–5), 19–31. https://doi.org/10.1016/S0898-1221(98)00112-6

[13] Çağman, N., & Enginoğlu, S. (2009). Soft topological spaces. *Computers & Mathematics with Applications, 57* (7), 1198–1207. https://doi.org/10.1016/j.camwa.2008.08

[14] Mohar, B., & Thomassen, C. (2001) . *Graphs*Johns Hopkins University Press . ISBN :(2001). *Graphs on Surfaces* . Johns Hopkins University Press. ISBN: 978-0801866336.