Fuzzy B**-opensets

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ABSTRACT

In this paper we introduce a new class of sets namely fuzzy B**-opensets. Further we introduce the concept of fuzzy B**-connectedness and fuzzy B**-compactness on a fuzzy topological space and some of their properties were investigated.

Keywords and phrases: Fuzzy B**-open, fuzzy B**-continuity, fuzzy B**-connectedness and fuzzy B**-compactness.

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1. Introduction

The concept of fuzzy set was introduced by Zadeh in his classical paper (Zadeh, 1965). Balasubramaniam and Sundaram defined generalized fuzzy closed sets in a fuzzy topological space and introduced certain types of fuzzy continuous functions between fuzzy topological spaces. In this paper we introduce a new concept of fuzzy B**-opensets. Also we introduce the new concept of fuzzy B**-connectedness and fuzzy B**-compactness and some of their properties were investigated.

2. Preliminaries

Let \((x, \tau)\) be a fuzzy topological space. A fuzzy subset \(\lambda\) of a fuzzy topological space (fts-space) is said to be fuzzy B- generalized closed set (briefly, Bg-closed) if Bcl \((\lambda)\) \(\subseteq\) \(\mu\) whenever \(\lambda \subseteq \mu\) and \(\mu\) is open in \((X, \tau)\). Also \(\tau (B)\) is defined as \(\tau (B) = \{\lambda \cup (\lambda' \cap \mu) : \lambda, \lambda' \in \tau\}\) where \(B \not\in \tau\). Then Bcl \((\lambda)\) is given by. Bcl \((\lambda) = \bigcap \{S \subseteq X : \lambda \subseteq S\) and S is closed in \(\tau (B)\}\}. A fuzzy
subset of X belonging to τ(B) is denoted by fuzzy B – open set and the complement of fuzzy B – Open set is denoted by fuzzy B – closed set. The family of all fuzzy B – open sets is denoted by FBO(X) and the family of all fuzzy B-closed sets is denoted by FBC(X). A fuzzy subset λ of a topological space (X, τ) is called fuzzy semi-open set if λ ⊆ Cl (Int λ) and it is semi – closed set if int (cl (λ)) ⊆ λ. A mapping f : (X, τ) → (Y, S) is called a fuzzy B – continuous if f⁻¹(V) is a fuzzy B – closed set in (X, τ) for every closed set V in (Y, S).

3. Fuzzy B** - Open set

Definition (3.1)

A fuzzy subset λ of a fuzzy topological space (X, τ) is said to be fuzzy B** - open if and only if there exist an open set μ such that μ ⊆ λ ⊆ B Cl (λ).

Example (3.1) Let X = {a, b, c}

τ = { 0, λ, μ, λ ∩ μ, λ ∪ μ, 1 }

λ(a) = 0.4    μ(a) = 0.2    s(a) = 0.5
λ(b) = 0.6    μ(b) = 0.3    s(b) = 0.8
λ(c) = 0.6    μ(c) = 0.5    s(c) = 0.8

Here (X, τ) is a fuzzy topological space and λ is a f B** open set.

Theorem (3.1)

Let (X, τ) be a fuzzy topological space. A fuzzy subset λ of X is f B** - open in X if and only if λ ⊆ B cl (int λ).
Proof

Suppose that $\lambda$ is a fuzzy $B^{**}$-open set of $(x, \tau)$. Then there exist an open set $\mu$ such that $\mu \subseteq \lambda \subseteq B\text{ cl}(\mu)$. If $\mu \subseteq \lambda$ then $\mu \subseteq \text{int}(\lambda)$. Hence $fB\text{ cl}(\mu) \subseteq fB\text{ cl}(\text{int}\lambda)$. Therefore $\lambda \subseteq fB\text{ cl}(\text{int}\lambda)$.

Conversely, Let $\lambda \subseteq fB\text{ cl}(\text{int}\lambda)$. To prove $\lambda$ is a $fB^{**}$-open set in $X$, let $\mu = \text{int}(\lambda)$. Then $(\mu) \subseteq \lambda \subseteq fB\text{ cl}(\mu)$. Hence $\lambda$ is $fB^{**}$-open set in $(x, \tau)$.

Remark (3.1)

If $\mu$ is a fuzzy open set in $(x, \tau)$ then $\mu$ is a $fB^{**}$-open set.

Theorem (3.2)

If $\lambda$ and $\mu$ are fuzzy $B^{**}$-open sets of a fuzzy topological space $(X, \tau)$, then $\lambda \cup \mu$ is also fuzzy $B^{**}$-open in $X$.

Proof

Given $\lambda$ and $\mu$ are fuzzy open sets of $X$, then there exist open sets $U$ and $V$ such that $U \subseteq \lambda \subseteq B\text{ cl}(U)$ and $V \subseteq \mu \subseteq B\text{ cl}(V)$. And also $B\text{ cl}(U \cup V) \subseteq \lambda \cup \mu \subseteq B\text{ cl}(U \cup V)$. Hence $\lambda \cup \mu$ is also fuzzy $B^{**}$ open set in $X$.

Remark (3.2)

If $\lambda$ and $\mu$ are fuzzy $B^{**}$-open sets in $X$, then $\lambda \cap \mu$ need not be fuzzy $B^{**}$ open set in $X$.

Theorem (3.3)

Let $(x, \tau)$ be a fuzzy topological space. If $\lambda$ is a fuzzy $B^{**}$-open sets in $X$ and $\mu$ be any set such that $\lambda \subseteq \mu \subseteq B\text{ cl}(\text{int}\lambda)$ then $\mu$ is also a fuzzy $B^{**}$-open set in $X$.

Proof
Given $\lambda$ is a fuzzy $B^{**}$ open set in $X$. Then $\lambda \subseteq \mu \subseteq B\ cl\ (int\ (\lambda))$ implies $int\ (\lambda) \subseteq int\ (\mu)$. Hence $B\ cl\ (int\ (\lambda)) \subseteq B\ cl\ int(\mu)$. Therefore $\mu \subseteq B\ cl\ (int\ (\lambda)) \subseteq B\ cl\ (int\ (\mu))$. Hence $\mu$ is a fuzzy $B^{**}$ open set in $X$.

**Theorem (3.4)**

Let $(x, \tau)$ be a fuzzy topological space and if $\lambda$ is a fuzzy $B^{**}$-open set in $X$ then $\lambda$ is fuzzy semi–open in $x$.

**Proof**

Given $\lambda$ is fuzzy $B^{**}$-open set in $x$, then then exists an open set $U$ such that $U \subseteq \lambda \subseteq B\ cl\ (U)$. Since $B\ Cl\ (U) \subseteq Cl\ (U)$ then $U \subseteq \lambda \subseteq Cl\ (U)$. Therefore $\lambda$ is fuzzy semi–open.

**Definition (3.2)**

Let $\lambda$ be a fuzzy subset of a fuzzy topological space $(x, \tau)$. Then $\lambda$ is said to be fuzzy $B^{**}$-closed if its complement is fuzzy $B^{**}$ open set.

**Definition (3.3)**

Let $(x, \tau)$ be a fuzzy topological space. Let $\lambda$ be a fuzzy subset of $X$. Then the fuzzy $B^{**}$ closure of $\lambda$ is defined as the intersection of all fuzzy $B^{**}$ closed sets containing $\lambda$ and it is denoted by fuzzy $B^{**} \ Cl\ (d)$. Fuzzy $B^{**} - Cl\ (\lambda) = \cap \{ F : F \text{ is fuzzy } B^{**} \text{ closed and } \lambda \subseteq F \}$.

**Definition (3.4)**

A fuzzy topological space $(x, \tau)$ is said to be fuzzy $B^{**} - T_{1/2}$ space if every fuzzy $B^{**}$-openset of $X$ is open in $X$.

**Definition (3.5)**

Let \((x, \tau)\) be a fuzzy topological space and be \(\lambda\) be a subset of \(X\). Let \(x \in X\) is said to be fuzzy \(B^*\) limit point of \(A\) if and only if every fuzzy \(B^*\) open set containing \(x\) contains at least one point other than \(x\).

**Definition (3.6)**

Let \((x, \tau)\) be a fuzzy topological space. Let \(\lambda\) be a fuzzy subset of \(X\). Then the set of all fuzzy \(B^*\) limit points of \(\lambda\) is said to be fuzzy \(B^*\) derived set of \(\lambda\), and it is denoted by \(FDB^*(\lambda)\).

**Theorem (3.5)**

Let \(\lambda\) be a fuzzy subset of a fuzzy topological space \((x, \tau)\) and \(FBD^*(\lambda)\) be the set of all fuzzy \(B^*\) limit points of \(\lambda\). Then \(B^* \overline{\text{cl}}(\lambda) = \lambda \cup FDB^* (\lambda)\).

**Proof**

Let \(\lambda\) be a fuzzy subset of \(X\). Let \(x \in \lambda \cup FDB^* (\lambda)\). Then either \(x \in \lambda\) or \(x \in FDB^* (\lambda)\). If \(x \in \lambda\), then \(x \in FDB^* (\lambda)\). If \(x \in \lambda\), then \(x \in B^* \overline{\text{cl}}(\lambda)\).

If \(x \in FDB^* \overline{\text{cl}}(\lambda)\), then every fuzzy \(B^*\) open set containing \(x\) will intersect \(\lambda\). Therefore \(x \in B^* \overline{\text{cl}}(\lambda)\). This implies \(\lambda \cup FDB^* (\lambda) \subseteq B^* \overline{\text{cl}}(\lambda)\).

If \(x \in B^* (\lambda)\), then we have to prove \(x \in \lambda \cup FDB^* (\lambda)\). If \(x \in \lambda\), then \(x \in \lambda \cup FDB^* (\lambda)\). If \(x \notin \lambda\), then \(x \in B^* \overline{\text{cl}}(\lambda)\) implies every fuzzy \(B^*\) open set of \(x\) intersects with \(\lambda\). Hence \(x \in FDB^* (\lambda)\). Therefore, \(B^* \overline{\text{cl}}(\lambda) = \lambda \cup FDB^* (\lambda)\).
Theorem (3.6)

Let \( f : X \to Y \) be a homeomorphism from a fuzzy topological space \( X \) into a fuzzy topological space \( Y \). If \( \lambda \) is a fuzzy \( B^{**} \)-open set in \( Y \) then \( f^{-1}(\lambda) \) is fuzzy \( B^{**} \)-open in \( X \).

Proof

Let \( f \) is a homeomorphism from a fuzzy topological space \( X \) into a fuzzy topological space \( Y \). Given \( \lambda \) is fuzzy \( B^{**} \)-open set in \( Y \). Then there exist an open set \( U \) in \( Y \) such that \( U \subseteq \lambda \cap \text{Bcl}(U) \) implies \( f^{-1}(U) \subseteq f^{-1}(\lambda) \subseteq f^{-1}(\text{Bcl}(U)) \). Since \( f \) is a homeomorphism and also we have \( f^{-1}(\text{Bcl}(U)) \subseteq \text{Bcl}(f^{-1}(U)) \). Therefore \( f^{-1}((U) \subseteq f^{-1}(\lambda)) \subseteq \text{Bcl}(f^{-1}(U)) \) and hence \( f^{-1}(\lambda) \) is a fuzzy \( B^{**} \)-open set in \( X \).

4. Fuzzy \( B^{**} \) continuous maps

Definition (4.1)

A function \( f \) from a fuzzy topological space \((X, T)\) into \((Y, S)\) is said to be fuzzy \( B^{**} \)-continuous map if the inverse image of every open set in \( Y \) is fuzzy \( B^{**} \)-open in \( X \).

Theorem (4.1)

Let \( f : X \to Y \) be a continuous map from a fuzzy topological space \( X \) in to a fuzzy topological space \( Y \) is fuzzy \( B^{**} \)-continuous map.

Proof

Let \( U \) be a fuzzy open set in \( Y \). Since \( f \) is continuous, \( f^{-1}(U) \) also open in \( X \). Then \( f^{-1}(U) \) is fuzzy \( B^{**} \)-open in \( X \). Hence \( f \) is fuzzy \( B^{**} \) continuous.

Example

Let \( X = Y = \{a, b, c\} \) and \( \alpha, \beta : X \to [0,1] \) be defined as

\[
\begin{align*}
\alpha(a) &= 0.3, \\
\alpha(b) &= 0.7, \\
\alpha(c) &= 0.9, \\
\beta(a) &= 0.5, \\
\beta(b) &= 0.1, \\
\beta(c) &= 0.8.
\end{align*}
\]
\[ \alpha(x) = \begin{cases} 1 & \text{if } x = a \\ 0 & \text{otherwise} \end{cases} \]

\[ \beta(x) = \begin{cases} 1 & \text{if } x = b \\ 0 & \text{otherwise} \end{cases} \]

Consider \( \tau = \{0, 1, \alpha\}, \sigma = \{0, 1, \beta\} \) Now \( (X, \tau) \) and \( (Y, \sigma) \) are the fuzzy topological spaces Define a map \( f : (x, \tau) \rightarrow (y, \sigma) \) by \( f(a) = b, f(b) = c \) and \( f(c) = a \). Then \( f \) is fuzzy B** continuous map.

**Theorem (4.2)**

Let \( f : X \rightarrow Y \) be a mapping from a fuzzy topological space \( X \) into a fuzzy topological space \( Y \). Then the following statement are equivalent.

(a). \( f \) is fuzzy B** continuous

(b). the inverse image of each fuzzy closed set in \( Y \) is fuzzy B** closed set in \( X \).

**Proof**

(a) \( \Rightarrow \) (b) : Let \( C \) be any fuzzy closed set in \( Y \), then \( Y - C \) is open in \( Y \). Since \( f \) is fuzzy B** continuous then \( f^{-1}(Y - C) \) is fuzzy B** - open in \( X \). Therefore \( X - f^{-1}(C) \) is fuzzy B** open in \( X \) which implies that \( f^{-1}(C) \) is fuzzy B** closed set in \( X \).

(b) \( \Rightarrow \) (a) : Let \( U \) be a fuzzy open set in \( Y \), then \( Y - U \) is fuzzy closed in \( Y \). This implies \( f^{-1}(Y - U) \) is fuzzy B** - closed set in \( X \), which implies \( X - f^{-1}(U) \) is fuzzy B** closed in \( X \). Therefore \( f^{-1}(U) \) is fuzzy B** closed set in \( X \). Hence \( f \) is fuzzy B** continuous.

**Theorem (4.3)**

If \( f : X \rightarrow Y \) is a fuzzy B** continuous map from a fuzzy topological space \( X \) in to fuzzy topological space then \( f (B^* \text{cl}(\lambda)) \subseteq \text{cl} (f(\lambda)) \).
Proof

Since \( f(\lambda) \subseteq \text{cl}(f(\lambda)) \) then \( \lambda \subseteq f^{-1}(\text{cl}(f(\lambda))) \). But \( \text{cl}(f(\lambda)) \) is a fuzzy closed set in \( y \) and \( f \) is fuzzy \( B^* \)-continuous map. Therefore \( f^{-1}(\text{cl}(f(\lambda))) \) is fuzzy \( B^* \)-closed in \( X \). Hence \( B^* \text{cl}(\lambda) \subseteq f^{-1}(\text{cl}(f(\lambda))) \). Therefore \( f(B^* \text{cl}(\lambda)) \subseteq \text{cl}(f(\lambda)) \).

Theorem (4.4)

If \( f : X \rightarrow Y \) be a mapping from a fuzzy topological space \( X \) into a fuzzy topological space \( Y \), then the following statements are equivalent.

(i) For each \( x \in X \) and each fuzzy open set \( V \) containing \( f(x) \), there exists a fuzzy \( B^* \)-open set \( U \) containing \( x \). Such that \( f(U) \subseteq V \).

(ii) \( f(B^* \text{Cl}(\lambda)) \subseteq \text{cl}(f(\lambda)) \) for all subset \( \lambda \) of \( x \).

Proof

(i) \( \Rightarrow \) (ii) : Let \( x \in X \) and \( V \) be a open set containing \( f(x) \), then \( f^{-1}(V) \) is fuzzy \( B^* \)-open in \( X \). Let \( \lambda = X - f^{-1}(V) \) then \( \lambda \) is fuzzy \( B^* \)-closed in \( X \). Since \( f(B^* \text{cl}(\lambda)) \subseteq \text{Cl}(f(\lambda)) \) then \( f(B^* \text{cl}(\lambda)) \subseteq \text{Cl}(f(x-f^{-1}(V))) \subseteq \text{cl}(Y-V) = V' \). Since \( x \in V \) and \( x \not\in V' \) then \( x \not\in f(B^*(\text{cl}(\lambda))) \). Then there exist a fuzzy \( B^* \)-open set \( U \) of \( x \) such that \( U \cap \lambda' = \emptyset \) imples \( U \subseteq \lambda' \). Hence \( f(U) \subseteq f(\lambda) \subseteq V' \).

(ii) \( \Rightarrow \) (i) : Let \( y \in f(B^* \text{cl}(\lambda)) \). Then there exist \( x \in f(B^* \text{cl}(\lambda)) \). such that \( f(x) = y \). Let \( V \) be any open set containing \( f(x) \), then there exist a fuzzy \( B^* \)-open set \( U \) containing \( x \) such that \( f(U) \subseteq V \) and \( U \cap \lambda \neq \emptyset \) which implies \( f(U \cap \lambda) \subseteq f(U) \cap f(\lambda) \subseteq V \cap f(\lambda) \neq \emptyset \). Therefore \( x \in \text{cl}(\lambda) \). Hence \( f(B^* \text{cl}(\lambda)) \subseteq \text{cl}(f(\lambda)) \).
5. Fuzzy B** - irresolute maps

Definition (5.1)

A mapping f from a fuzzy topological space X into a fuzzy topological space Y is called fuzzy B** - irresolute if the inverse image of every fuzzy B** - open set of Y is fuzzy B** - open in X.

Theorem (5.1)

Let f : X → Y be mapping from a fuzzy topological space X into a fuzzy topological space Y. And if f : X → Y be a fuzzy B** - continuous map from X into Y and if Y is fuzzy B** - T_{1/2} space then f is fuzzy B** - irresolute.

Proof

Let f : X → Y be fuzzy B** - continuous let λ be fuzzy B** - open set in Y. Since Y is fuzzy B** - T_{1/2} then λ is an opense in Y. Since f is fuzzy B** - continuous implies f^{-1}(λ) is fuzzy B** - open in X. Therefore f is fuzzy B** - irresolute map.

Theorem (5.2)

In a fuzzy topological space the composition of fuzzy B** - irresolute map is a fuzzy B** - irresolute map.

Proof

Let X, Y, Z be fuzzy topological spaces, Let f : X → Y and Let g : Y → Z be any two fuzzy B** - irresolute maps. Let U be a fuzzy B** - open set in Z, then g^{-1}(V) is fuzzy B** - open in Y which implies f^{-1}(g^{-1}(U)) is B** - open in X. Therefore (g o f)^{-1}(U) fuzzy B** - open in X. Hence (g o f) is fuzzy B** - irresolute.
6. Fuzzy B** - Compact Sets

Definition (6.1)

Let B be a fuzzy subset of a fuzzy topological space (X, τ). Then a collection \( \{ A_\alpha ; \alpha \in J \} \) of fuzzy B** - open sets is said to be fuzzy B** - open cover for a subset B of X if \( B \subseteq \bigcup \{ A_\alpha ; \alpha \in J \} \) holds.

Definition (6.2)

A fuzzy topological space (X, τ) is said to be fuzzy B** compact if for every B** - open cover of X has a finite subcover.

Definition (6.3)

A fuzzy subset B of a fuzzy topological space X is said to be fuzzy B** - compact relative to X, if for every collection \( \{ A_\alpha ; \alpha \in J \} \) of fuzzy B** - open subsets of X such that \( B \subseteq \bigcup \{ A_\alpha ; \alpha \in J \} \), then there exists a finite subcollection such that \( B \subseteq A_1 \cup A_2 \cup \ldots \cup A_n \).

Theorem (6.1)

If a fuzzy subset \( \lambda \) is fuzzy B** - closed subset of a fuzzy B** - compact fuzzy topological space X then \( \lambda \) is fuzzy B** - compact relative to X.

Proof

Let \( \lambda \) be a fuzzy B** - closed subset of a fuzzy topological space (X, τ). Then \( \lambda' \) is a fuzzy B** - open set in X. Let \( \{ A_\alpha = \alpha \in J \} \) be a fuzzy B** - open cover for \( \lambda \), then \( \{ \lambda' : \lambda_\alpha, \alpha \in J \} \) forms a fuzzy B** - open cover for X. Since X is a fuzzy B** - compact then fuzzy B** - open cover has a finite subcover \( \{ G_1, G_2, \ldots, G_n \} \). If this finite subcover contains \( \lambda' \) discard it otherwise leave the
subcover as it is. Thus we obtained a finite fuzzy $B^{**}$-open cover for $\lambda$. Therefore $\lambda$ is fuzzy compact relative to $X$.

**Theorem (6.2)**

The fuzzy $B^{**}$-continuous image of fuzzy $B^{**}$-compact space is fuzzy compact.

**Proof**

A mapping $f : X \rightarrow Y$ be fuzzy $B^{**}$-continuous map from a fuzzy topological $X$ onto a fuzzy topological space $Y$. Let $\{A_{\alpha} : \alpha \in J\}$ be an open cover for $Y$. The $\{f^{-1}(A_{\alpha}) : \alpha \in J\}$ is a fuzzy $B^{**}$-open cover for $X$. Since $X$ is fuzzy $B^{**}$-compact then this fuzzy $B^{**}$-open cover of $X$ has a finite subcover. $\{f^{-1}(\lambda_1), f^{-1}(\lambda_2), \ldots, f^{-1}(\lambda_n)\}$. Since $f$ is onto, $\{\lambda_1, \lambda_2, \ldots, \lambda_n\}$ be an open cover of $Y$. Therefore $Y$ is fuzzy compact.

**7. Fuzzy $B^{**}$-Connected sets**

**Definition (7.1)**

A fuzzy topological space $X$ is said to be fuzzy $B^{**}$-connected if $X$ cannot be written as the union of two disjoint nonempty fuzzy $B^{**}$-opensets. A fuzzy subset of $X$ is said to fuzzy $B^{**}$-connected if it is fuzzy $B^{**}$-connected as a subspace.
Theorem (7.1)

For a fuzzy topological space X, the following statements are equivalent.

(i). X is fuzzy B**-connected

(ii). The only fuzzy subset of X are, both fuzzy B**-open and closed are empty set and X.

(iii). Every fuzzy B**-continuous map of a fuzzy topological space X into a discrete space Y with atleast two points is a constant map.

Proof

(i) ⇒ (ii) Let μ be a fuzzy B**-open and fuzzy B**-closed subset of X, then X-μ is both fuzzy B**-open and fuzzy B**-closed. Since the fuzzy topological space X is the disjoint union of fuzzy B**-open set μ and X - μ implies one of these must be empty, that is μ = φ

(ii) ⇒ (i) Suppose X = λ = X - μ where λ and μ are fuzzy disjoint nonempty B**-open set of X, then λ = X - μ is fuzzy B**-closed. Hence λ is both fuzzy B**-open and fuzzy B**-closed subset of X. Then by assumption λ = φ or λ = x. This implies x is fuzzy B**-connected.

(ii) ⇒ (iii) Let f : X → Y be fuzzy B**-continuous, then X is covered by fuzzy B**-open and fuzzy B**-covering {f⁻¹(y) : y ∈ y}. By assumption f⁻¹(y) = φ, then f is not fuzzy B**-continuous. Therefore f⁻¹(y) = x. This implies f is a constant map.

(iii) ⇒ (ii) Let μ be both fuzzy B**-open and fuzzy B**-closed in X. Suppose μ ≠ φ. Let f : x → y be fuzzy B**-continuous maps defined by f(μ) = {y} and f(x-μ) = {w}
for some distinct points y and w in Y. By assumption f is a constant map. Therefore $\mu = x$.

**Theorem (7.2)**

i). If $f : X \rightarrow Y$ is a fuzzy $B^{**}$ - continuous surjection map and X is fuzzy $B^{**}$ - connected then Y is fuzzy connected.

ii). If $f : X \rightarrow Y$ is a fuzzy $B^{**}$ - irresolute surjection map and X is fuzzy $B^{**}$ - connected, then Y is fuzzy $B^{**}$ - connected.

**Proof :**

i). Suppose that Y is not fuzzy connected, then $Y = \lambda \cup \mu$, when $\lambda$ and $\mu$ are disjoint non-empty opensets in Y. Since f is fuzzy $B^{**}$ - continuous and onto then $X = f^{-1}(\lambda) \cup f^{-1}(\mu)$ where $f^{-1}(\lambda) \cup f^{-1}(\mu)$ are disjoint non – empty fuzzy $B^{**}$ - opensets which is a contradiction. That is X is $B^{**}$ - connected. Hence Y is fuzzy connected.

ii). Suppose that f is fuzzy $B^{**}$ - irresolute surjection map and also x is fuzzy $B^{**}$ - opensets then by the definition of fuzzy $B^{**}$ - connected ; it follows that Y is fuzzy $B^{**}$ - connected.
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