To understand and motivate the term of "Canonical embedding", we will explain the concept of "isomorphism", which is a general interest.

Spaces = a set X + a structure defined on X.

Space type	set of points	Structure
Metric Space	set X	metric
Vector Space	set X	two algebraic operations Addition + Scalar Multiplication
Normed Vector Space	set X	two algebraic operations and the norm

The "structure" is the main topic we care about, so we develop the concept of "<u>isomorphism</u>". Accordingly, an isomorphism T of a metric space $X = (X, d)$ onto a metric space $\hat{X} = (\hat{X}, \hat{d})$ is a bijective mapping which preserves distance. that is, $\forall x, y \in X \Rightarrow \hat{d}(Tx, Ty) = d(x, y)$

An isomorphism T of a vector space X onto a vector space $\tilde{X}$ over the same field is a bijective mapping which preserves the two algebraic operations thus, $\forall x, y \in X$ and scalar $\alpha \in F \Rightarrow T(x+y) = Tx + Ty$, $T(\alpha x) = \alpha T(x)$

Since canonical mapping C is linear and injective, it is an isomorphism of X onto the range $R(C) \subseteq X^{\#\#}$. If X is isomorphic with a subspace of a vector space Y, we say that X is <u>embeddable</u> in Y. Hence X is embeddable in $X^{\#\#}$, C is also called <u>the canonical embedding</u> of X into $X^{\#\#}$. If C is surjective (hence bijective), so that $R(C) = X^{\#\#}$, then X is said to be <u>algebraically reflexive</u>. We will prove that if X is finite dimensional (a finite subset span X and that set is linearly independent) then X is <u>algebraically reflexive</u>.

Note: A similar discussion involving norms and leading to the concept of <u>reflexivity</u> of a normed vector space will be presented when we introduce <u>dual space</u> X^*, which is the collection of bounded (continuous) linear functionals defined on X and the same way, <u>second dual space</u> X^{**}.