Consider the sequence of intervals $A_n = (-\frac{1}{n}, \frac{1}{n})$
Claim 1: $A_{n+1} \subset A_n$
Proof:
Let $x \in A_{n+1}$
$\implies -\frac{1}{n+1} < x < \frac{1}{n+1}$
$\implies -\frac{1}{n} < x < \frac{1}{n}$ as $\frac{1}{n} > \frac{1}{n+1}$
$\implies x \in A_n$
$\implies A_{n+1} \subset A_n$
Claim2:- $\bigcap_{n=1}^{\infty} A_n = \{0\}$
proof :-
Clearly $\forall n \in \mathbb{N}$ $0 \in A_n$.
$\implies 0 \in \bigcap_{n=1}^{\infty} A_n$
$\implies \{0\} \subset \bigcap_{n=1}^{\infty} A_n (1)$
Let $x \in \bigcap_{n=1}^{\infty} A_n$
$\implies \forall n \in \mathbb{N} -\frac{1}{n} < x < \frac{1}{n}$
$\lim_{n\to\infty} -\frac{1}{n} < \lim_{n\to\infty} x < \lim_{n\to\infty} \frac{1}{n}$
We know $\lim_{n\to\infty} -\frac{1}{n} = 0$
and $\lim_{n\to\infty} \frac{1}{n} = 0$
Since x is constant(w.r.t n) we have $\lim_{n\to\infty} x = x$
Also by sandwich theorem we have $\lim_{n\to\infty} x = 0$
Since limit of a sequence if exists is unique we have x = 0
Hence $\bigcap_{n=1}^{\infty} A_n \subset= \{0\}$ (2)
From 1 and 2 we have
$\bigcap_{n=1}^{\infty} A_n = \{0\}$