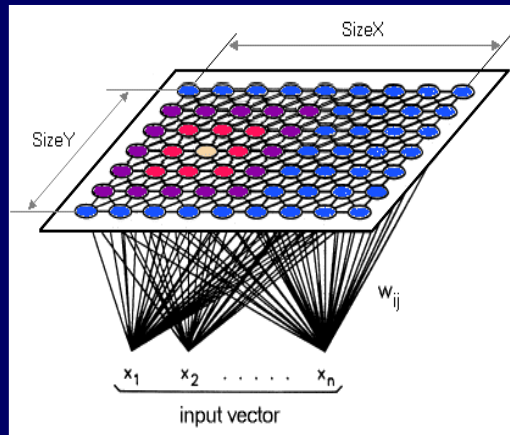


Data Mining of General Corrosion of Alloys, Using Kohonen Mapping

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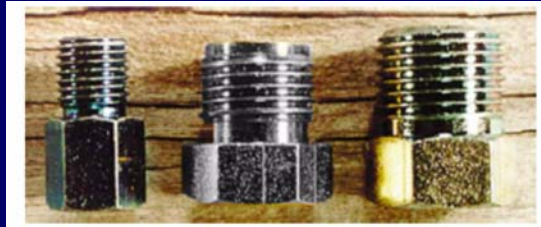
**Corrosion can accelerate failure mechanisms
to catastrophic failure**



[www.corrosion-doctors.org]

Carefully considering corrosion when selecting materials can extend a metal alloy's longevity

Zinc Before



Zinc After

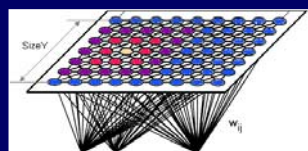


[www.tre.ngfl.gov.uk]

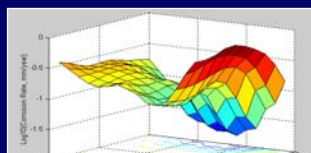
This talk discusses how Kohonen maps can be used to develop a new method for designing metal alloys

Environment	Vol %	pH	Cl ⁻	P	S	N
C	Cu	B	Fe	Mn	S	Si
Mg	Mo	Co	Ni	Ta	V	W

Formatted Data



Kohonen Maps Trained



Results

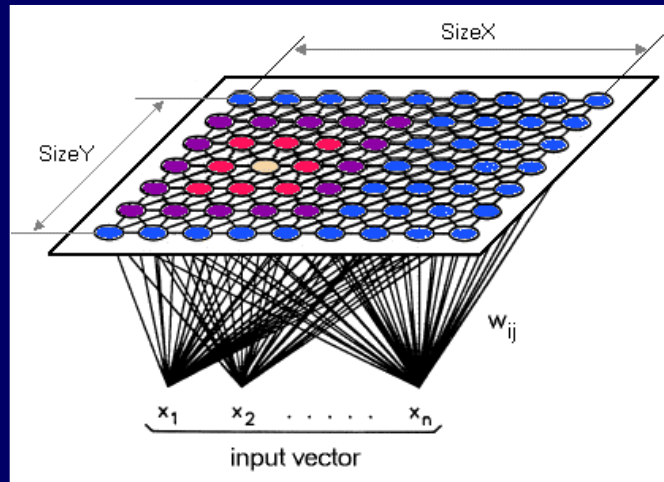
Data were formatted into vectors to be used in cluster analysis

Environment	Vol %	pH	Cl-	P	S	N	Na	F	Temp	Ni
C	Cu	B	Fe	Mn	S	Si	Al	Cr	Ti	P
Mg	Mo	Co	Nb	Ta	V	W	Y	Zr	Rates	Log(Rates)

After each vector was created, the numerical values were normalized in between -1 and 1

0.12	0.54	0.72	0.24	0.64
-1	0.45	1	-0.8	0.46875

Self-organizing maps preserve the topology of data by using competitive learning to cluster the data vectors

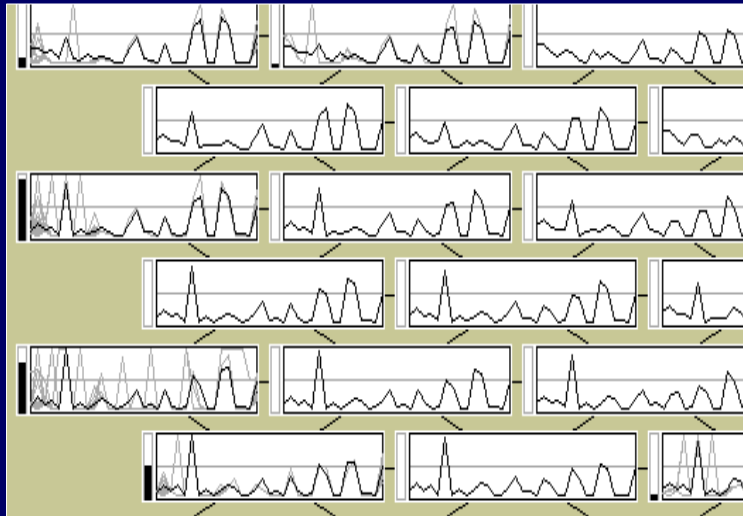


[www.sis.pitt.edu]

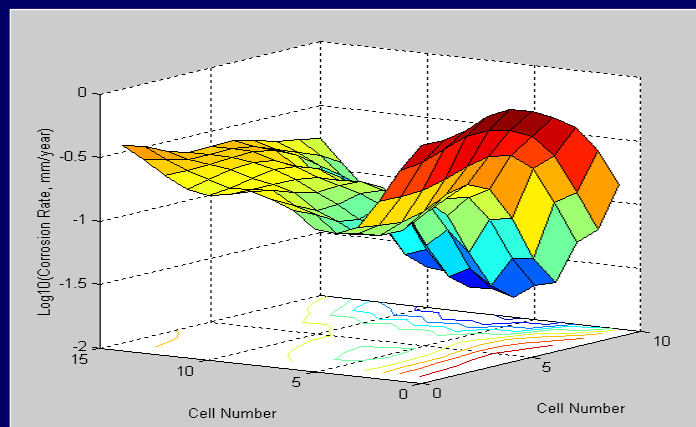
Each Kohonen cell stores one vector that represents the mean of the input vectors in that cell



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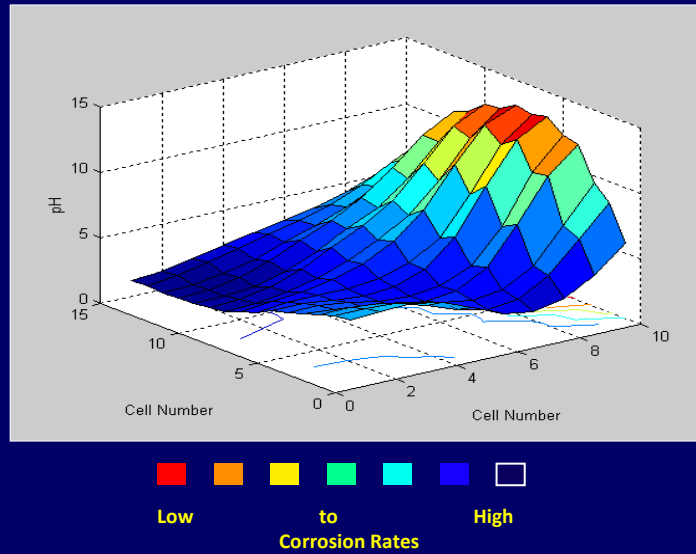


The logarithm of general corrosion rates is plotted on the z-axis for each of the trained Kohonen cells

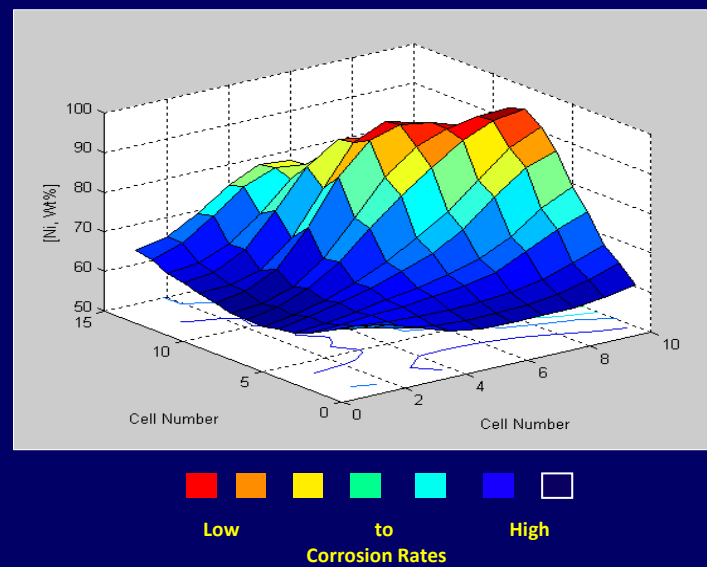


Low to High
Corrosion Rates

Nickel-based alloys present low corrosion rates at high pH levels and high corrosion rates at low pH levels



A higher weight percentage of Nickel results in higher resistance to corrosion

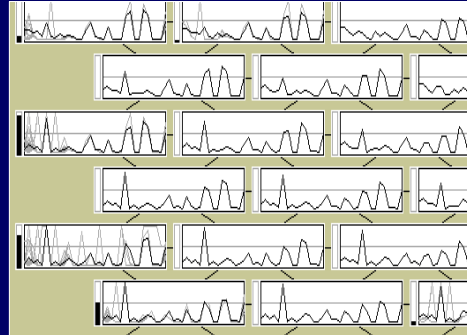


In summary, Kohonen Maps have the power to select an alloy that will be best fit to an environment

Input vectors containing corrosion rate data



Results in low-corrosion alloys in specific environment



Questions?

About the Presentation:

This presentation was delivered at the ASME Pressure Vessels and Piping Conference in Prague in July 2009. Kathryn Kirsch, a rising junior in Mechanical Engineering at Pennsylvania State University, gave the talk. The presentation won first place in the Bachelor/Master's category at the conference.

Acknowledgments:

The authors are very grateful to Dr. R. Ricker from NIST for providing the input data. The authors also appreciate support from PSU Women in Science and Engineering Research Program (WISER), College of Engineering, Mechanical Engineering Department, and ASME so that Kathryn Kirsch could attend this conference.