Singular value decomposition

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1 Approximation

1.1 Total least squares approximation

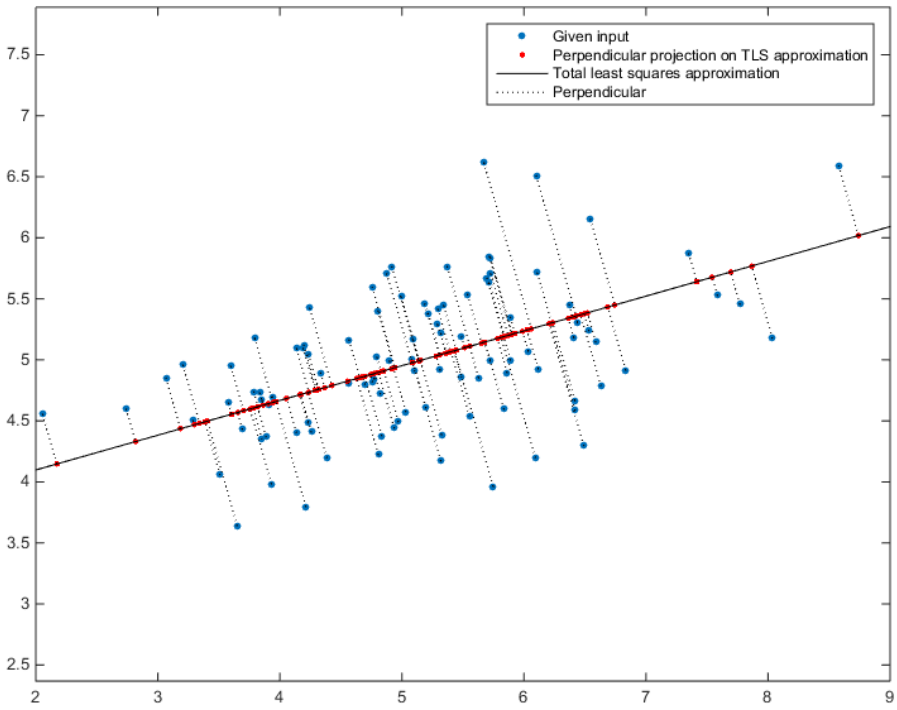

Figure 1: Total least squares approximation

1.2 Perpendicular squares sum

$$\mathrm{d}(\mathbf{p},\mathbf{q}) = \sqrt[2]{(p_1 - q_1)^2 + (p_2 - q_2)^2}$$

For given points and considering that square area is equal to $\mathrm{d}(p,q)^2$ we get

$$\sum \mathrm{d}(\mathbf{p},\mathbf{q})^2 = \sum_{i=1}^{n} d(p_i, q_i)^2 = 24.2419$$

Matlab code:

```
error = norm(A_approx-A).^2;
```

1.3 Different representations

$$\mathbf{x} = \{v_{2,1}, v_{2,2}\}$$

Matlab code:

```
x = V(2,:);
```

$$\alpha = v_{2,1} \cdot \bar{x} + v_{2,2} \cdot \bar{y}$$

Matlab code:

```
l1=V(2,1);
l2=V(2,2);
alpha=l1*xMean(1)+l2*xMean(2);
```

$$\mathbf{y_0} = A_{approximation}(0,0)$$

Matlab code:

```
A = [0 0 ;A];
... approximation code ...
y0 = A_approx(1,:);
```

$$\mathbf{s} = \{v_{1,1}, v_{1,2}\}$$

Matlab code:

```
s = V(1,:);
```

2 Motion capture sequence compression

2.1 Squares sum minimization

"R" rank	Optimal value
1	$4.6166 \cdot 10^8$
2	$1.6925 \cdot 10^8$
5	$1.0453 \cdot 10^7$
10	$1.1982 \cdot 10^6$
15	$2.5626 \cdot 10^5$

2.2 Linear combination of span vector

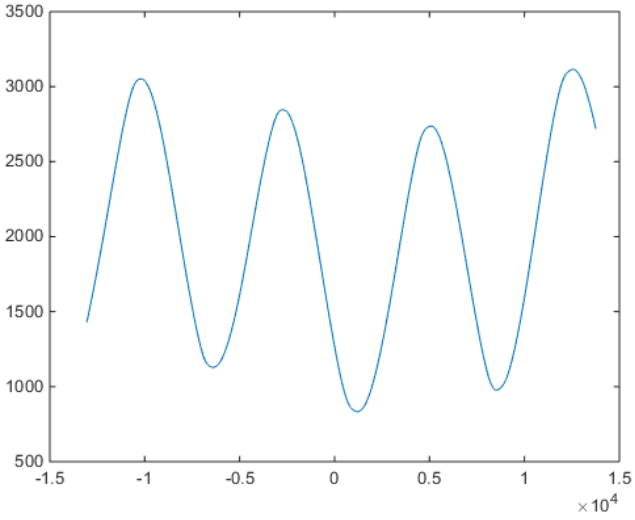

Figure 2: 'Chuze', r = 2

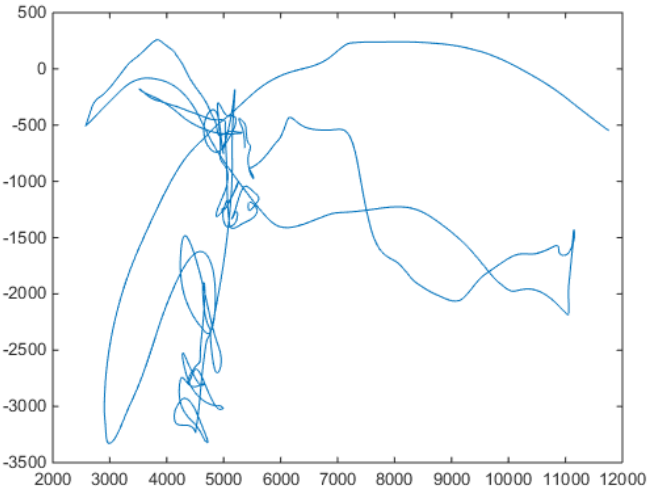

Figure 3: 'Makarena', r = 2

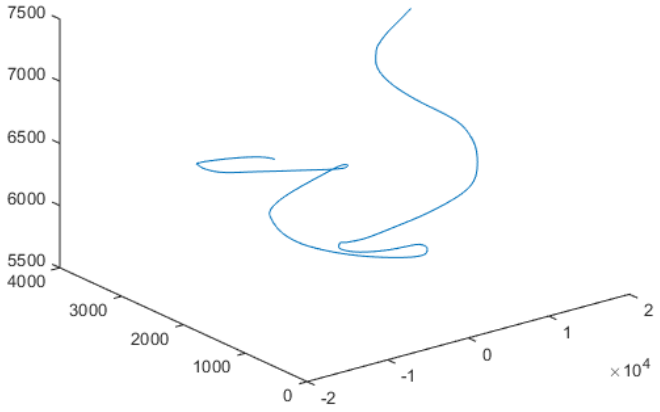

Figure 4: 'Chuze', r = 3

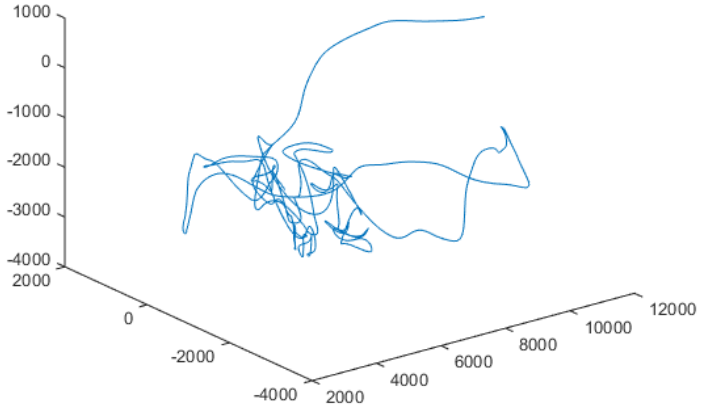

Figure 5: 'Makarena', r = 1

2.3 Minimization of approximation data dimension

Obviously there is a situation when n-dimensional movement can be approximated in 1-dimensional world with 0 error.

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